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MANDIBULAR CHANGES IN ORTHODONTIC TREATMENT

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AMONG the deformities to which the human family seems disposed, few have greater possibilities for marring the appearance of the face than those in which the mandibular structures are prominently involved. Under such conditions, important functional relationships are disrupted, and psychological handicaps inflicted which greatly militate against health and happiness. In view of the fact that the remedy for such conditions is sought almost exclusively within the field of dentofacial orthopedics, a discussion of the possibilities for relief, the degree of success which may be reasonably expected, and the various factors which condition favorable results, is a vital subject for our consideration. Observations, from a clinical standpoint, give assurance that much may be accomplished, but since a uniformity of response is not always attainable, additional information is needed, not only upon therapy but upon fundamental conditioning influences. It is in this spirit that the subject is approached, with the hope that the material presented may prove thought provoking, with the result that many others will pursue it and establish greater finality of opinion.

As a premise, let us first specify the anomalies which constitute this study so that our efforts will be directed to them and to the more relevant factors connected directly with them. Dental and oral anomalies fall under two general classifications; i.e., those designed as "eugnathic,"† in which the teeth only are involved, and those termed "dysgnathic,"† in which the maxilla or the mandible or both are included in the deformity. It is obvious, therefore, that our interest is

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†Terms suggested by Dr. B. E. Lischer.

centered upon this latter group where, inclusive with other anomalies, the mandibular strictures are underdeveloped and frequently malrelated in their facial relationships.

It has generally been assumed that where such growth aberrations are manifest a lower dental posterior malrelationship is also present. The recording of a large number of cases has established the fact that this dental status frequently does exist, although by no means as the universal rule, for numerous cases have also been noted in which the opposing first permanent molars and the adjacent teeth are in correct anteroposterior relationship, with accompanying mandibular structures showing marked deficiencies in growth. An even more numerous group of cases have been recorded in which the mandibular structures fall well within the range of the normal, with marked lower dental posterior malrelationships in evidence as extreme in every respect as those cases accompanied by mandibular growth deficiencies. Fig. 1 presents convincing testimony in support of these statements. Such evidence makes it quite apparent that dental and oral anomalies cannot be classified or described according to dental relationships alone, but that each contributing factor must be determined and named as it occurs in the individual case. In other words, any comprehensive plan must differentiate between all the dependent structures of the facial ensemble, with an effort to determine, as definitely as possible, the number, nature, and extent of all parts contributing to the anomaly. In carrying out any study of changes induced in the mandibular structures resultant upon orthodontic treatment, this is especially important if our deductions are to meet the demands of clinical accuracy. Furthermore, the method of recording such anomalies assumes real importance, with the factor of standardization being not only advantageous but absolutely essential. Whatever the plan employed, it must be adaptable to routine practice procedures if the clinical results of a large number of cases are to be made available as evidence.

Denture and facial records may be obtained by several methods used alone or in combination. The facial mask, as utilized by Dr. Calvin S. Case, faithfully portrays not only the mandible but the other dependent facial structures. When made at intervals during the span of treatment, these accurately demonstrate external evidence of growth changes in all dimensions. Roentgenographic profileographs, when made under the accurate conditions available through the use of the craniostat, as designed and utilized by Dr. Broadbent, also offer a means where a sequence of such studies, made of the same individual, supplies evidence most revealing in character. The clinical camera also provides a means for recording such anomalies. Medical literature bears abundant evidence of its usefulness as a means of recording all pathologic conditions of an external nature, and the method, when standardized to include the photostatic principle, becomes increasingly valuable. Growth sequences can be secured in any ratio of size established as the standard, and anatomic changes recorded in a manner fulfilling the demands of what we have designated as "clinical accuracy." This, it must be understood, might not be synonymous with mathematical accuracy, which is not essential in biologic studies.

When these methods are compared, they will present advantages and disadvantages. The making of facial masks involves a process which is unpleasant

to the patient, and so laborious to the orthodontist that a sequence of such records of the same patient, and of a sufficient number to constitute a conclusive study, lies outside the realm of routine practice. Older patients might be will-

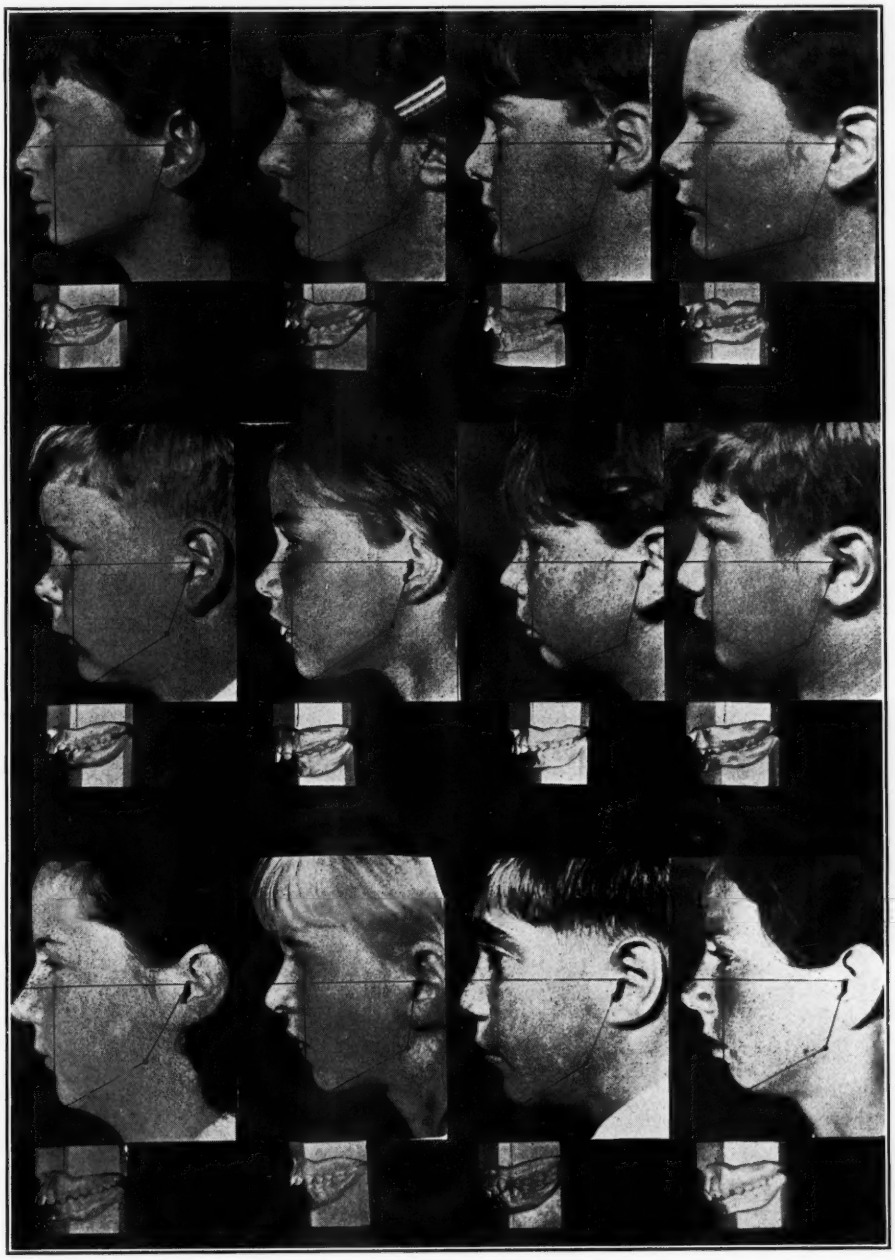

Fig. 1.—A study in dental and oral anomalies. *Upper row:* Mandibular structures within the range of the normal, but with all dentures having lower dental posterior malrelationships. *Center row:* Dentures similar to those in the upper row, but with the mandibular structures included in the deformity. *Lower row:* Molars and bicuspids in correct anteroposterior relationship, but with mandibular structures exhibiting characteristics similar to those shown in the center row.

ing to submit to the process, but the child patient, with his apprehensive attitude toward dental procedures, is not a fit subject. Furthermore, the facial mask

does not create a "living impression," the result being that resemblance is so vague that recognition is difficult. In our clinical work we are dealing with living subjects, and the interpretations we make are the result of the impressions our eyes receive. When, therefore, our facial records do not reveal more than mere form and are deprived of facial expression, we are handicapped. Many of these same drawbacks apply to roentgenographic profileographs. Certainly they have anything but a lifelike appearance, and while they do show the hard and soft tissues of the face and dependent relationships of the teeth, they are totally lacking in perspective and resemblance to the patients being recorded. As a supplemental record to some other form capable of more universal interpretation, they are to be recommended, provided they are made under the exact and scientific technic provided by the craniostat.

When facial records are made by the clinical camera, this must be used under standardized conditions, as has already been emphasized. Even such

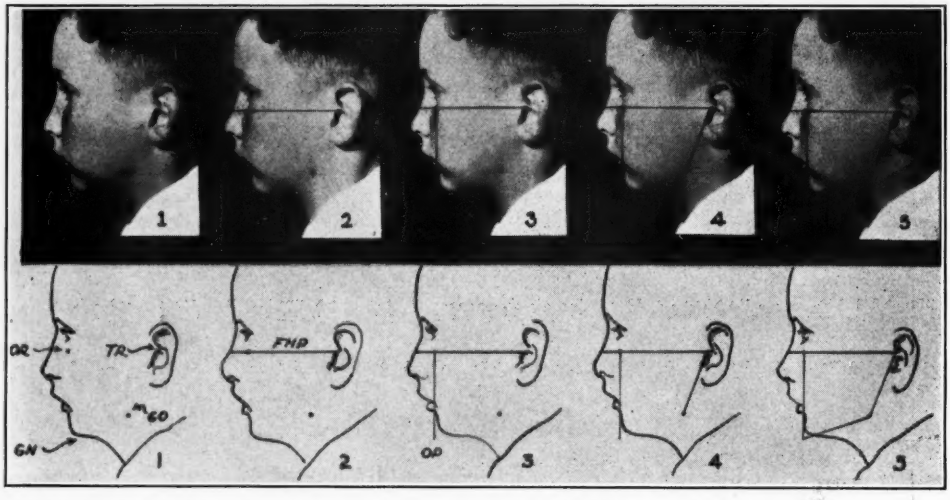

Fig. 2.—A series of photographs and drawings showing the method of charting photostatic facial records. First, the Frankfort horizontal plane is established, then the orbital plane, followed by the lineal representation of the mandible.

OR, orbitale; *TR*, tragion; *GN*, gnathion; *GO*, gonion; *FHP*, Frankfort horizontal plane; *OP*, orbital plane.

photographs are not perfect, for they are perspective projections in which the different points and individual parts are projected with varying degrees of angularity, those farthest removed from the lens appearing smaller, whereas those nearer appear larger. With the use of a proper lens, however, and other photographic facilities, this error diminishes to such an extent, and is so definitely computable, that it becomes a negligible factor; therefore, is not a handicap to the method. The eye also views objects with the factor of perspective present, so that the mild degree of distortion in photostatic records does not disturb our reactions or our judgment. Furthermore, facial expressions, and even minute individual peculiarities, are reproduced, and all this is accomplished with a minimum amount of labor. This in itself commends it as being the most practical for office use. This conclusion is strengthened by the fact that not only

a sequence of records can easily be made of each individual, but a large amount of material collected of many individuals, which is essential if conclusions are to merit conviction.

The value and the facility of interpretation of photostatic records are increased by charting them in such a manner that anatomic changes are computable. The fact that man walks upright and stands at a right angle to the horizontal plane of the earth's surface makes the Frankfort horizontal plane especially useful. Furthermore, the anatomic points for computing it are easily located as it passes through the tragia and orbitalia. At the Frankfort convention, anthropologists selected the left side so that a degree of standardization

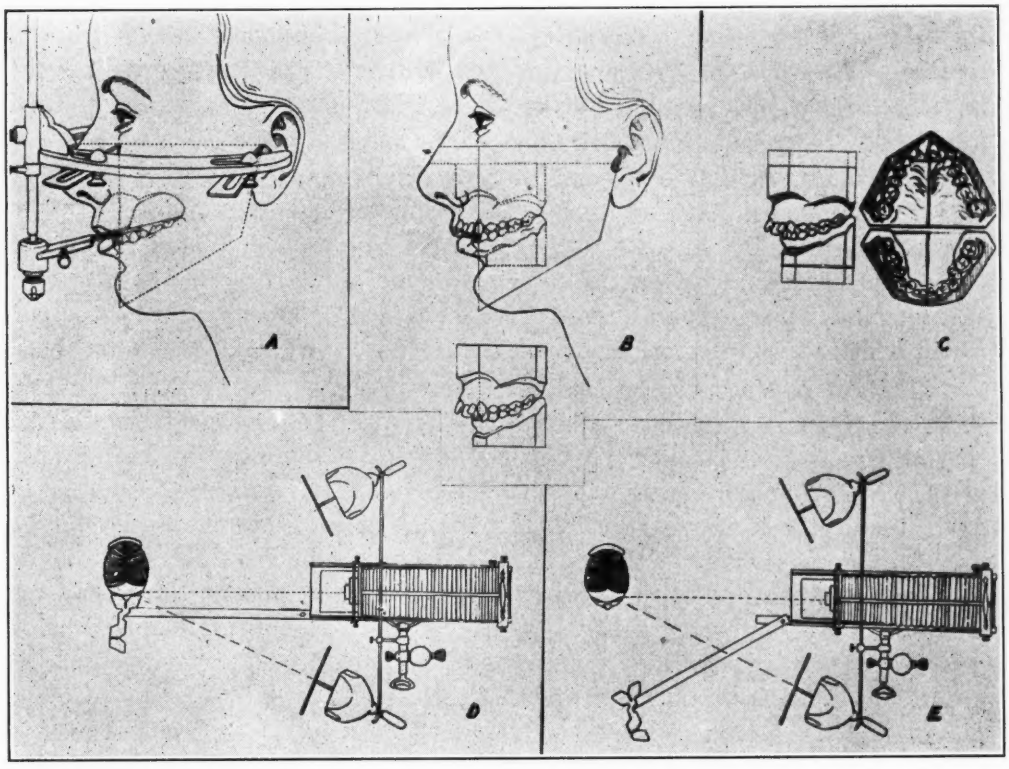

Fig. 3.—A brief outline of the plan used to record cases: (*A*) Obtaining the upper impression for a "related" denture reproduction. (*B*) Principles involved in such a reproduction, showing its relation to the Frankfort horizontal and orbital planes. (*C*) Identifying markings upon a denture reproduction showing its relationship within the face. (*D*) The method of posing a patient for a photostatic facial record. (*E*) Showing the noseboard removed and the source of lighting essential in making the exposure.

could be achieved. From the orbitale a plane is created at right angles to the Frankfort plane which passes downward, intersecting the facial structures, and is extended to a point on a level with the frontal portion of the mandible. In addition, a lineal representation of the mandible is made by lines drawn from the tragion to the gonion, and from this point forward through the gnathion, these measuring points all having been established by proper markings upon the face prior to making the photograph. It remains only necessary then to construct these upon the photographic print by running lines through the various points mentioned. This plan is demonstrated in Fig. 2. It will be quite obvious

that such charting will enable us more efficiently to observe and study the points, lines, angles, and conformation of the features, and especially the lower half of the face, and to discern therein changes having a direct bearing upon our problem. When we add to such records "related denture reproductions," made in a manner to show their orientation to dependent facial structures, our powers of observation are heightened and our interpretations rendered more accurate. It is by this method that the studies presented in this essay have been recorded, all with the same camera, the same lens, a constant ratio of life-size, uniform lighting, and other factors of standardization.* The series of drawings in Fig. 3 illustrate the principles involved.

In carrying forward our subject, the question of "norm patterns" is an important consideration. We know that in the evolution of the human face and its parts, such as the maxilla and the mandible, certain morphologic patterns have been developed. In spite of the ever-present factor of variation manifest by a wide divergence of size and other characteristics, these organic parts have certain essential similarities which must be present if the normal is complied with. These normal patterns have a genetic foundation, determined by the manner in which the chromosomes unite, and thereby establish what we may refer to as the "hereditary potential" for development. Many things may occur subsequent to this germinal organization to impede or modify or alter the part, a fact which seems to be amply demonstrated in our own field.

While it is generally assumed that "like produces like" to the extent that there are general resemblances between parents and offspring, it is also true that other ancestors back of the father and mother may enter in the formation of the new individual and thereby provide for new and numerous combinations in the chromosomal organization. The matter of resemblance or nonresemblance, therefore, does not always offer safe guidance in the matter of determining expectancy of growth patterns in children suffering from deformities wherein the mandible figures so conspicuously. Furthermore, the mere fact that one or both parents may possess a similar deformity does not necessarily mean that the growth potential for a normal mandible in their offspring is not present. Such parents might conceivably have had the same potential, and yet had it nullified or made inert through pathologic or other unfavorable environmental agencies.

Conklin in his book, *Heredity and Environment,* states: "The general tendency of recent work on heredity is unmistakable, whether it concerns man or lower animals. The entire organism, consisting of structures and functions, body and mind, develops out of the germ, and the organization of the germ determines all the *possibilities* of development of the mind no less than of the body, though the actual realization of any possibility is dependent also upon environmental stimuli." This principle has found ample verification in the field of dentofacial orthopedics, but lack of uniformity in treatment results impresses us with the necessity for a more accurate knowledge of conditioning influences.

As a premise, we may assume: *first,* that the primary essential to the achievement of a normal mandible lies in heredity—in other words, the germinal po-

*For the past ten years the author has recorded all cases in this manner.

tential must be present; *second,* pathologic or other inhibiting influences to growth must be eliminated; *third,* some form of stimuli capable of awakening osteogenetic and other growth activities must be brought into action; and *fourth,* these efforts must be inaugurated during those periods of childhood or early adolescence when growth responses of sufficient magnitude may be brought about to overcome the results of past inhibiting influences.

Whatever the mechanism of new bone formation and growth may be, we know that it can be brought about under favorable conditions. Physiologists have estimated that there are over eight hundred centers of ossification in the human body, the first of which appears about the fifth week of prenatal life. More than half this number, however, do not become established until after birth, and many of them not until the onset of adolescence. This brings the natural conclusion that most bones, at least during the growing period, are possesssed of ossification centers which are amply distributed. This is demonstrated in the case of the general skeleton by the sternum, which has nine. The mandible grows from six ossific centers, one being responsible for the condylar process, one for the coronoid process, another for the angle. The region between the mental foramina and the inner surface of the body, each has an ossific center, while the alveoli and other bony supports of the teeth evolve from still another source. In the deformed mandible, therefore, regardless of the part affected, whether it be the rami, the body, or some particular subdivision of these parts, the fact remains that under favorable conditions, the expectancy that normal patterns can be developed from the incomplete structure is not unreasonable.

Regardless of the influence of these original ossific nuclei, the findings of Macewen support this assumption. These were based upon carefully conducted experiments upon animals and clinical results demonstrated upon humans. In his book, *The Growth of Bone,* he states "that as soon as liberated from their confinement through stimuli, injury or operation, the bone corpuscles revert to their vegetative functions and have the power of direct and vigorous proliferation . . . thereby initiating reactive processes within the bone, adaptive in character, which result in marked bone changes . . . that any agent or condition which, while increasing and prolonging the proliferating power of the osteoblasts, does not lower their vitality will tend to increase bone formation . . . the younger the animal, the greater is the proliferating power of the bone cell, and the longer will it continue to proliferate before it assumes its mature form; consequently, the greater is the ossific production. The proliferating power of the osseous tissue of old animals is greatly reduced compared with those of animals in the evolutionary period, and the osteoblasts which are poured out from them pass quickly into their matured form. . . . The bone-forming power of animals of the same species varies. Not only are there marked individual differences, but there may be marked variation in the proliferating power in the same individual in the same year." This résumé of facts has a definite application in our field and has been verified clinically in numberless instances by those qualified to make such intepretations.

Since all bones are plastic, and alter their form in response to the demands made upon them, it follows that the mandible also modifies its outward form

and internal structure when altered or increased requirements are made upon it. This is perhaps but another way of stating the fundamental biologic principle that form and function are mutually dependent, both in growing processes and in maintaining the equilibrium of bodily parts. It also serves as a supplemental explanation of Wolff's law of bone transformation which, in brief, is "that the external form and internal structure of bone change with every alteration of function," or stated otherwise, "The amount of growth in bone depends upon the need for it." Experienced anatomists can, in examining skeletons, readily determine the degree of power and strength possessed by individuals during life by the manner in which structural organization in the bones has occurred to provide supports for the action of the muscles.

From these facts and other evidence, the importance of establishing normal functional habits in the treatment of our cases is rendered emphatic, especially in those in which marked supplemental growth changes are essential. In this task the pressures resulting from muscle tone and pull not only are helpful but are necessary for the development of normal patterns of form and size. In the matter of functional habits, therefore, we have a subject of vast importance to orthodontics. We know that perhaps no two of our patients perform the act of mastication (or other functions participated in by the oral structures) in exactly the same way. Some favor the right side, others the left, while others exhibit the ability to use both, just as some people are right-handed, some left-handed, and some ambidextrous. Similar variations may be seen in the manner in which individuals walk, for we know that regardless of military training, or other forms of discipline, when released from such restraints their natural gait is reassumed. These functional habits are hereditary, or at least the basis of their performance has a genetic foundation. Conklin states that "Physiological peculiarities are inherited as well as morphological ones; indeed function and structure are only two aspects of one and the same thing, namely organization. For all morphological characters there are functional correlatives, for functional characters morphological expressions, and if the one is inherited so is the other." The effect of variations in the masticatory habits of normally developed individuals is frequently apparent through the careful analysis of the facial and oral structures where definite asymmetries may often be demonstrated. While entirely within the physiologic range, these may include difference in length and thickness of the two halves of the mandible, and the corresponding muscles supplying the functional stimulus.

Prosthetists, and others interested in restorative dentistry, frequently criticize orthodontists because they fail to bring about occlusal results which will meet the same standards of balance supplied in artificial dentures, and in extensive full mouth restorations where ideal cuspal and other interdependent dental relations are established with adult patients. They fail to realize that their problem and the orthodontic problem have been one factor in common; i.e., the establishment of function. Each must approach it under radically differing conditions. Through the use of instruments which faithfully portray mandibular movements, they are able to determine the amount and location of necessary additions or modifications in the masticatory apparatus, and meet these needs by *mechanical means in the laboratory.* As the result of such procedures, denture

relationships, complying with the standards of mechanical balance, are achieved. Orthodontists must carry on their efforts with the teeth and their supporting structures constantly working in the articulator furnished by nature, and with materials, the supply of which, except for the teeth, *is dependent upon the growth factor*. This, we know, is as variable as the functional habits of the individual, and has limits established beyond which we cannot go; i.e., those prescribed by the genetic foundation. The goal of our efforts, therefore, cannot be predetermined by a norm based upon mechanics alone.

While the muscles of mastication, such as the masseter, the temporal, the external and internal pterygoids are important in our problem, they are no more so than the group made up by the platysma, digastric, mylohyoid, and the geniohyoid, and last, but by no means least, that "maker" or "breaker" of orthodontic results, the orbicularis oris, and the various groups of ribbon muscles radiating from it. Associated with the specific type of deformity under discussion, we find many of these exhibiting the results of disuse and, because of the altered size and position of the bone, acting as potent malfunctioning forces. The task, therefore, of revived growth and altered form in these muscular parts assumes equal importance with those sought within the bones. This interdependence has been demonstrated not only in general orthopedics but in our own field by Dr. Alfred P. Rogers, who has given us sound principles of myofunctional therapy.

In spite of the fact that we may assume that normal function is a law governing growth patterns, we must realize that it is not the only one in force. Our facial structures being a part of the living organism, it follows that they are affected by the nutritive and other changes that condition life and health. The orthodontist must have suitable material to work upon if his efforts are to meet with success, for he is at all times dependent upon the responsiveness of growing, changing structures.

In addition to factors already mentioned, we know the complex process of growth depends upon necessary food factors in the way of proteins, fats, carbohydrates, and the necessary minerals and vitamins, for the tissues must be maintained in a state of health if the tempo of growth changes is to proceed unretarded. We have also been given to understand that the endocrine bodies play an important rôle, and that dysfunction of these glands may account for delays or retardations, or other profound effects upon bodily growth. Orthodontists in general are assuming a conservative attitude toward this subject, with the hope that the claims of endocrinologists that this field will eventually present a definite therapy, with orthodontics being among the chief beneficiaries, will be fully realized.

Where marked mandibular changes take place in orthodontic treatment, many observers have debated the manner and location where these have occurred. Some have claimed that the altered form of the bone is made possible by changes in the glenoid fossa; others that modification in the angle is effected; while still others feel that no change in the bone itself is effected, save in its alveolar portion and in the structures immediately surrounding the teeth. Obviously most of these observations were made before reliable means of recording changes had been utilized. Even from the evidence to be presented in this study,

which is not given as being complete, it seems safe to assume that any and all parts of the mandible may be modified, with the degree of change occurring, showing a variability, but being more definite when treatment measures are instituted during the active growing period.

An explanation of the illustrations used to demonstrate changes in the mandible will make them more comprehensive. Fourteen cases have been selected, each of which has been recorded several times during treatment, with such records showing the facial structures and also the denture. Each has been uniformly assembled, and through the aid of a draftsman the facial outlines have been traced in ink exactly as revealed in each photograph. Each tracing was then moved below the photograph, and by using a white background the results have been made clearly discernible. Across these traced outlines, in addition to

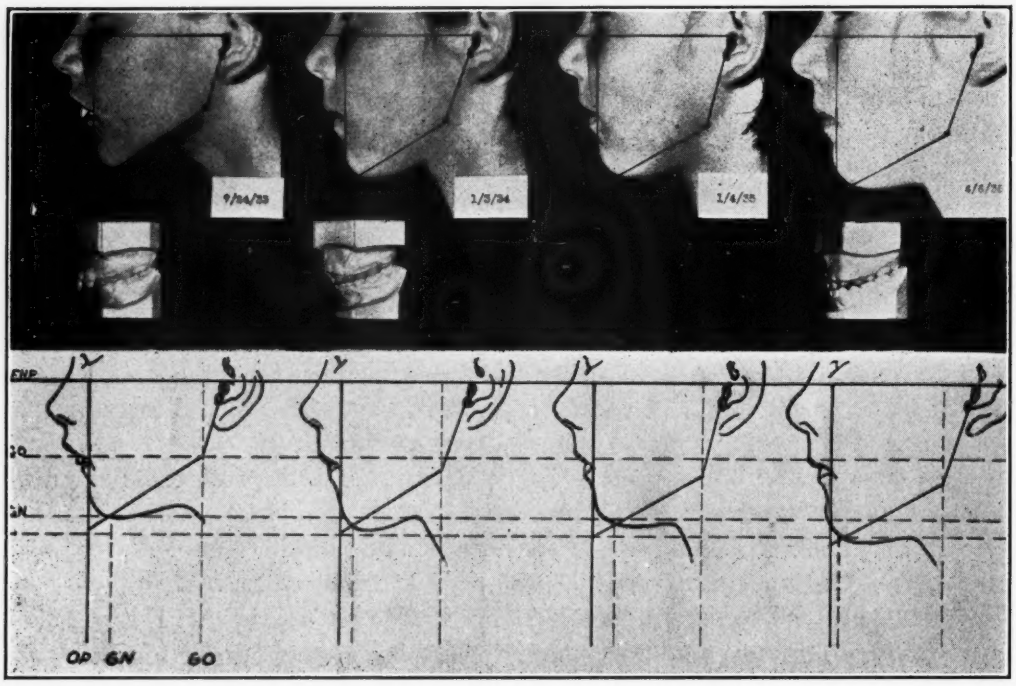

Fig. 4.—A girl nine years of age. In studying this, and subsequent illustrations, first follow the horizontal line indicated by *GO* from left to right, and note changes in the length of the ramus; then follow, from left to right, the horizontal line *GN*, which will reveal increased vertical growth. A study of the vertical lines, represented by *OP* and *GN*, and their relationship to the vertical line *GO* will reveal growth changes in the body of the mandible. Other alterations of interest may be noted from the study of the combination of vertical and parallel lines.

the Frankfort horizontal plane and the orbital plane, parallel dotted lines have been run. Starting at the left, the lines are run through the gonion and the gnathion in both a horizontal and a vertical direction, so that by following these through, changes in the length of the ramus and body of the mandible are made manifest. The relationship of the gnathion to the orbital plane is also demonstrated, and any growth change in the facial area, if it has occurred, vertically or horizontally, becomes immediately evident.

In Fig. 4, a girl nine years of age, a series of records is presented in which the original state of deformity shows that, in addition to other changes, the need

of a marked increase in the length of the ramus is essential. It will be obvious that this has occurred. Again, in Fig. 5, a boy twelve years of age, this same need is apparent, and has progressively occurred as treatment has advanced.

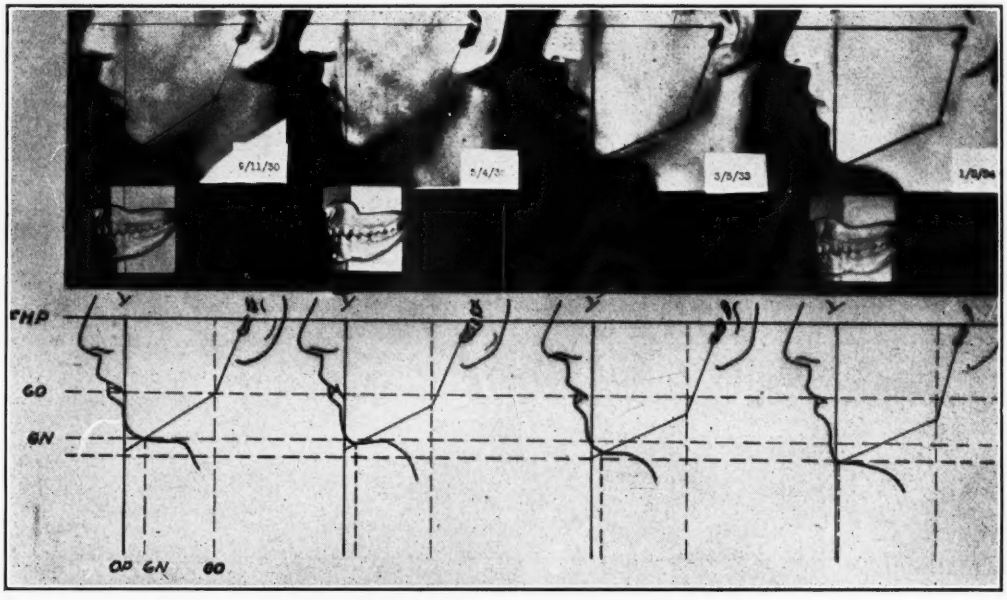

Fig. 5.—A boy twelve years of age.

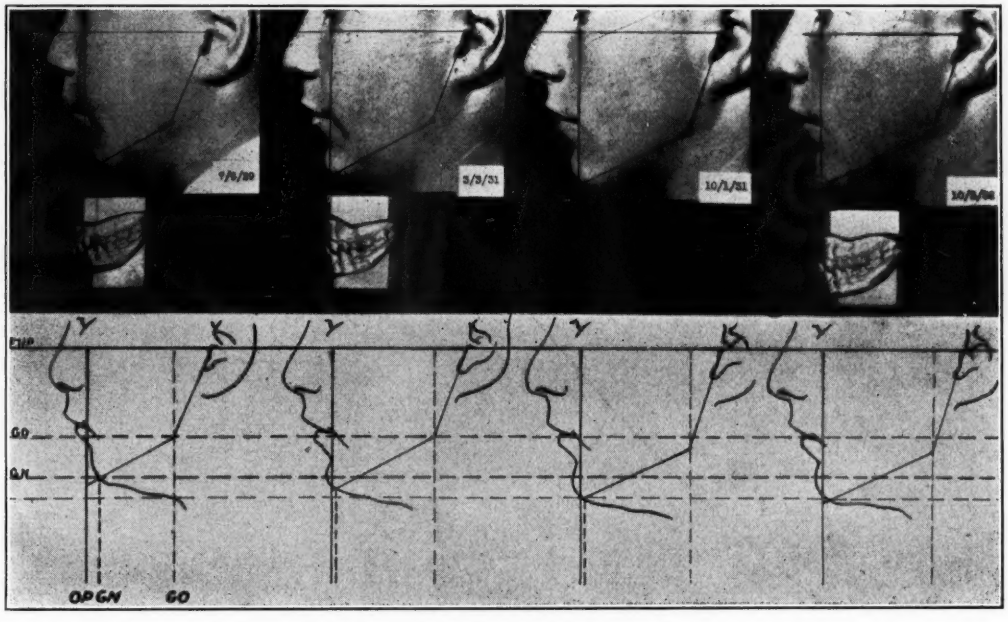

Fig. 6.—A boy fourteen years of age.

In Fig. 6, a boy fourteen years of age, a case is presented in which the body of bone shows the greatest need for growth changes, and this has taken place as treatment has gone forward. Again, in Fig. 7, a girl ten years and five months of age, and in Fig. 8, a boy eight years of age, this same need is apparent, and has progressively ensued.

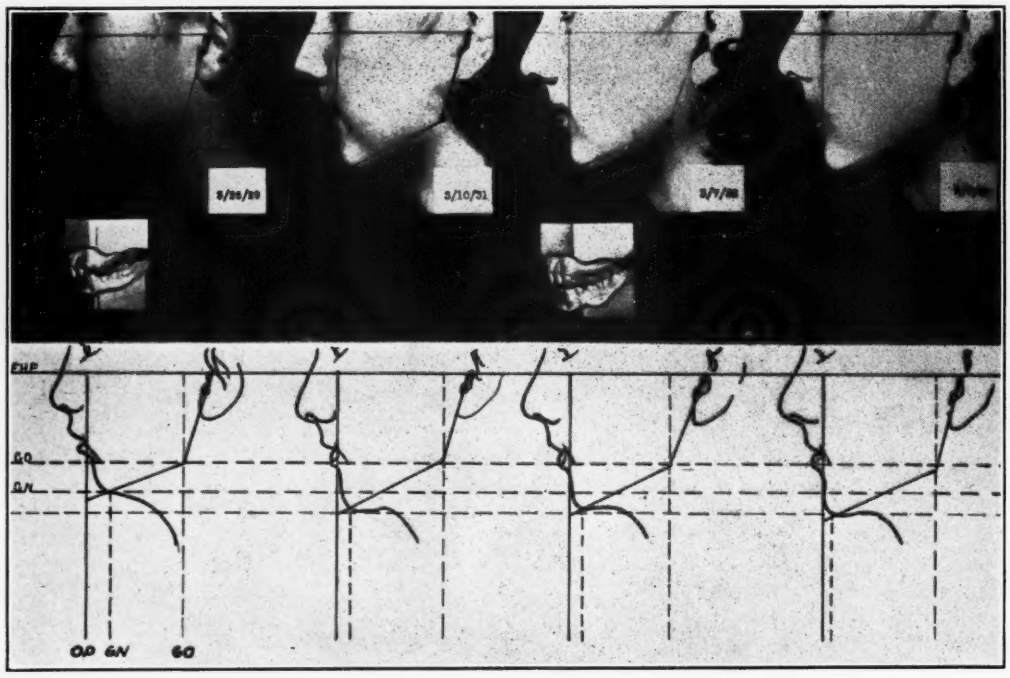

Fig. 7.—A girl ten years and five months of age.

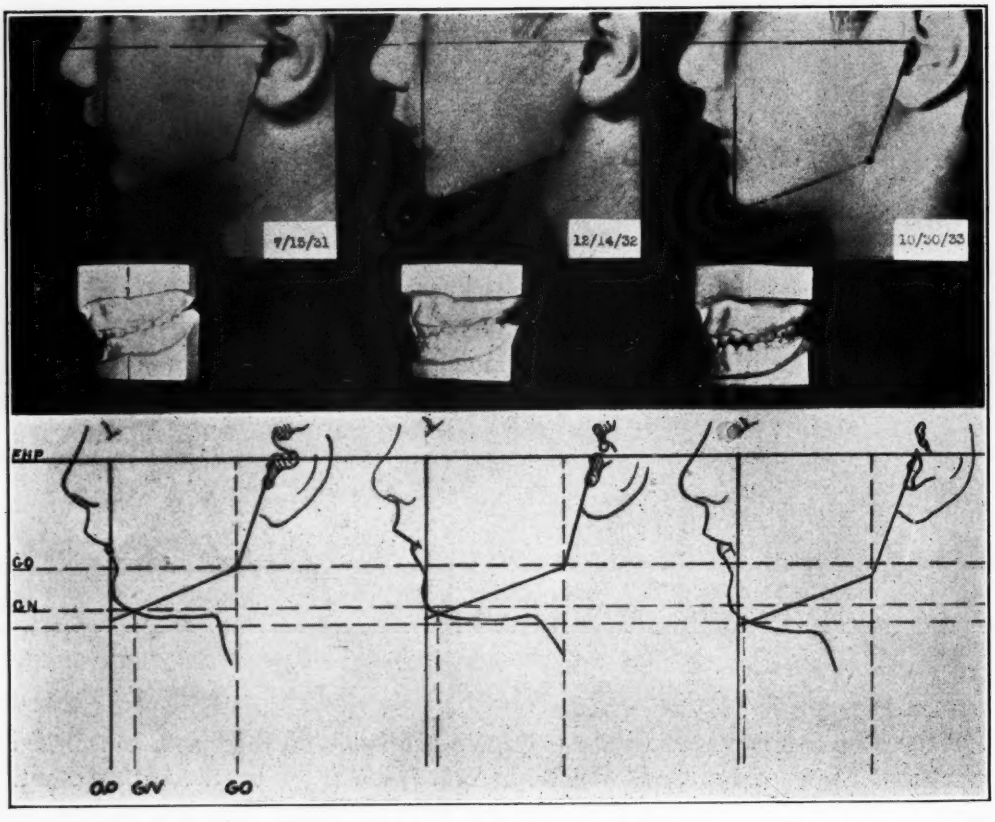

Fig. 8.—A boy eight years of age.

A study of Fig. 9, a boy nine years of age, shows the need of growth changes in both the body and the ramus. In spite of a favorable age period, the desired

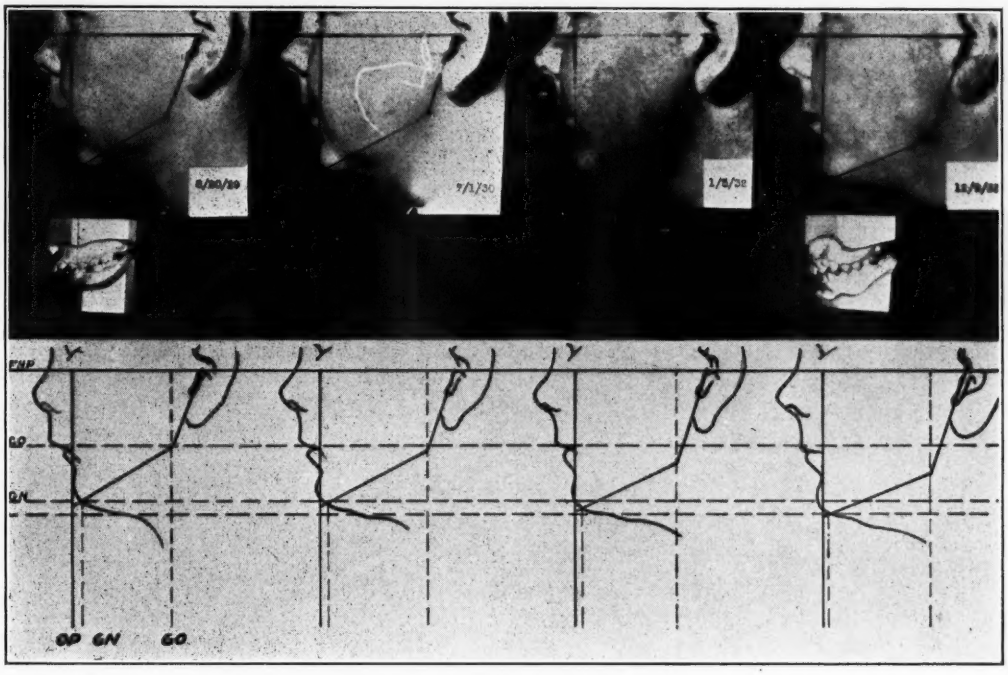

Fig. 9.—A boy nine years of age.

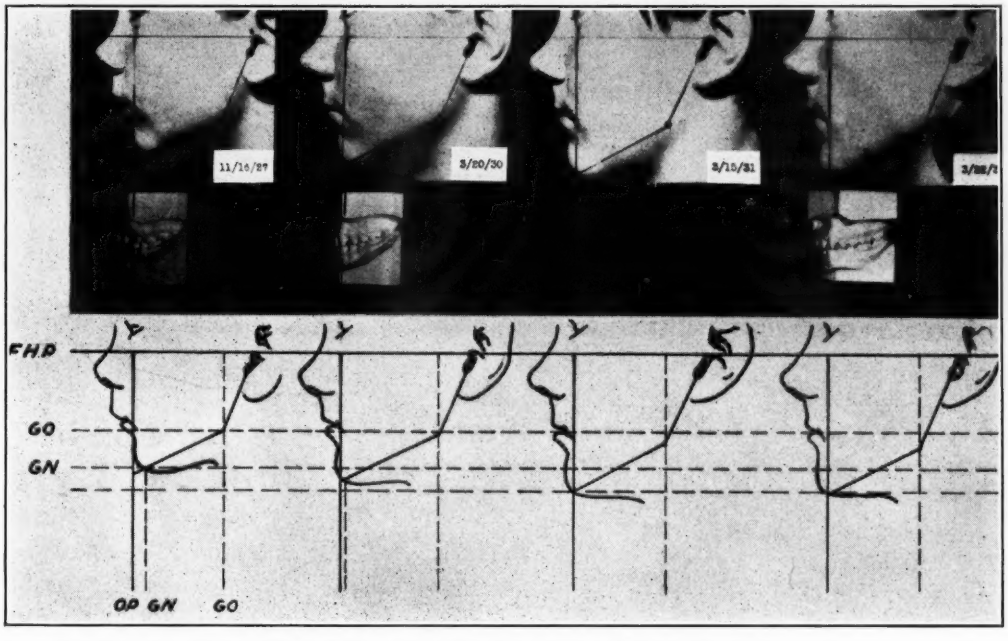

Fig. 10.—A girl ten years of age.

anatomic changes ensued slowly. A similar case is shown in Fig. 10, a girl ten years of age, where a greater proportionate increment is demonstrated in the early stages of treatment. An even more marked instance of rapid favorable

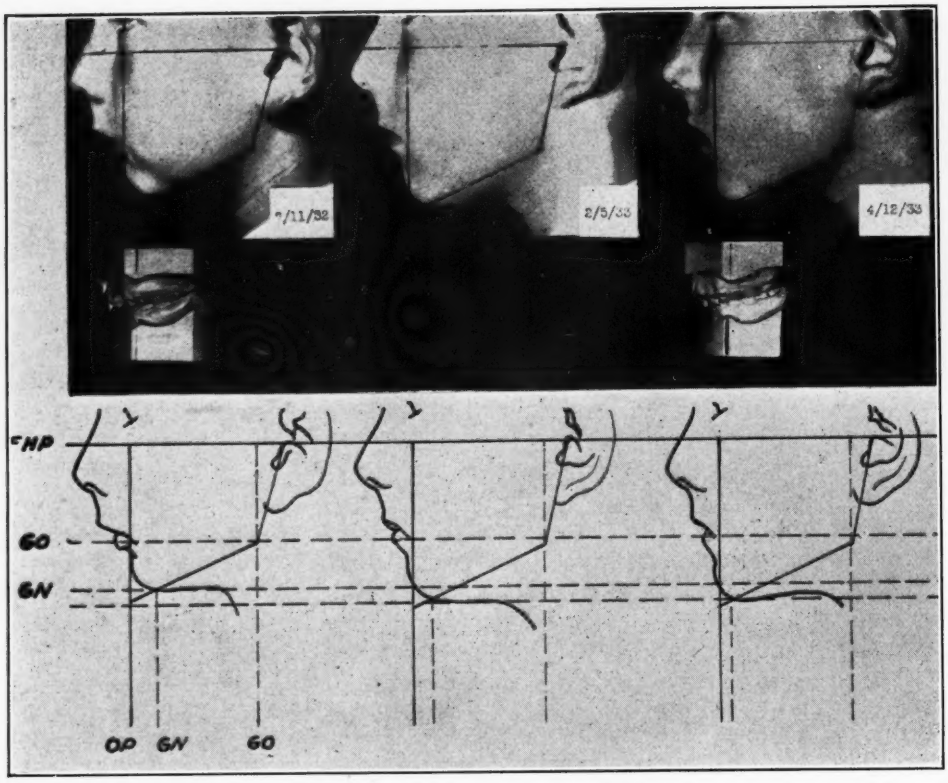

Fig. 11.—A boy nine years of age.

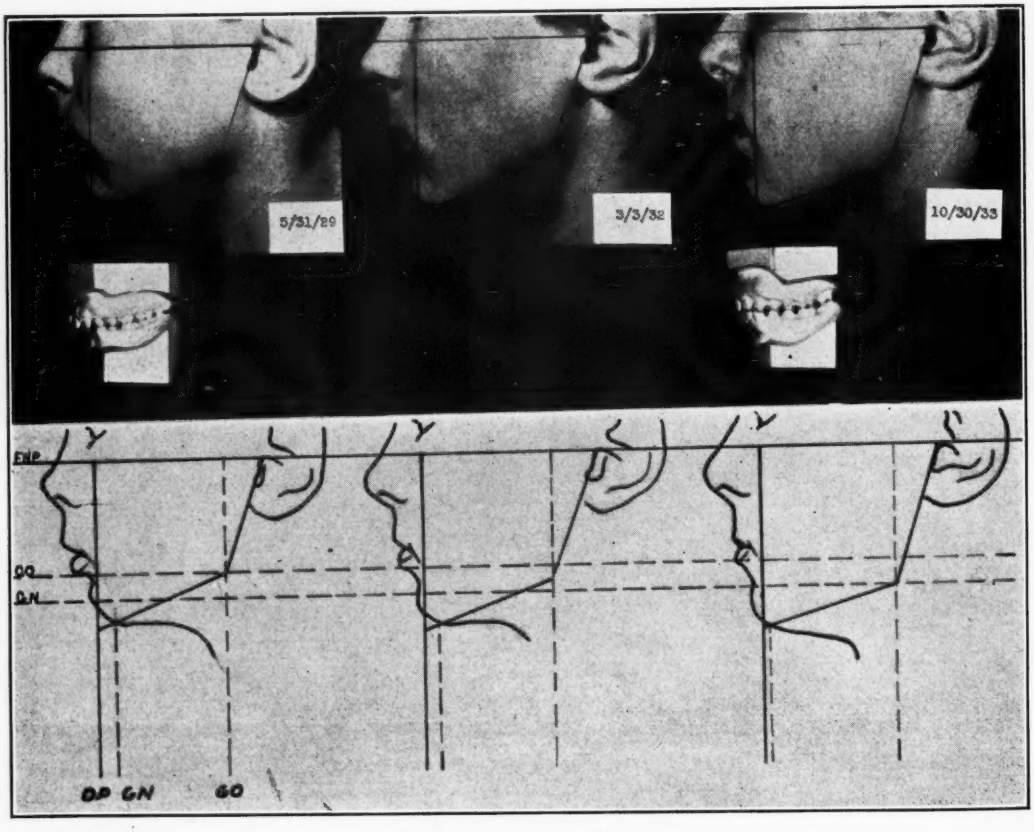

Fig. 12.—A girl ten years of age.

change is demonstrated in Fig. 11, a boy nine years of age, where, it will be noted, seven months only have elapsed between the first and the last recording.

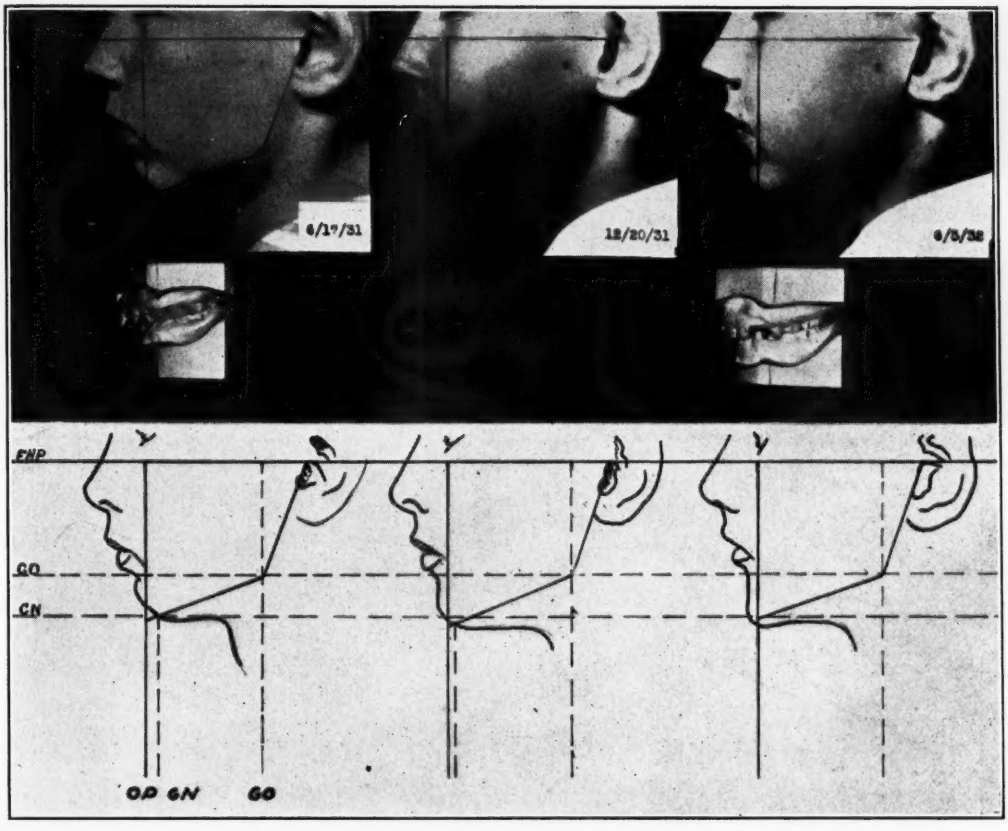

Fig. 13.—A boy nine years of age.

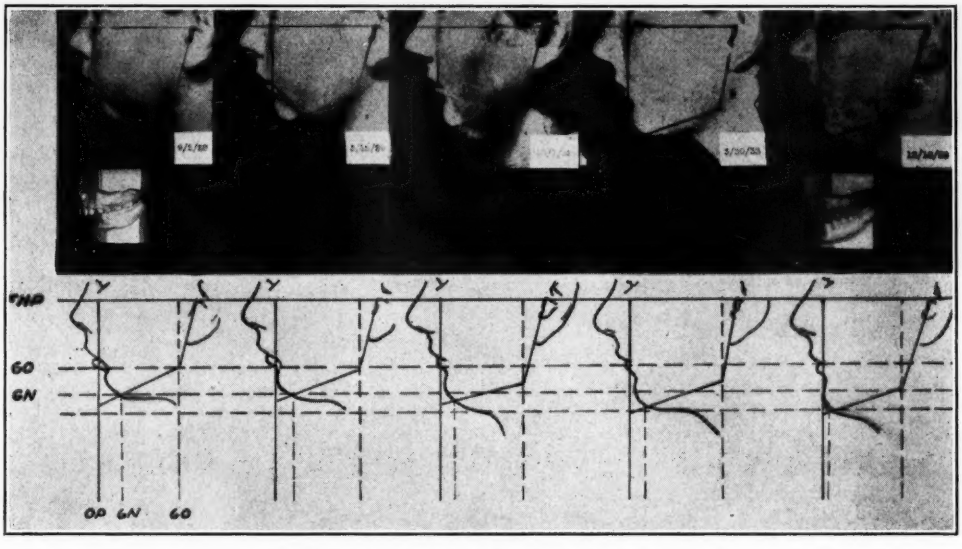

Fig. 14.—A girl eight years of age.

In the next three illustrations a very troublesome and disfiguring type of mandibular deformity is demonstrated; i.e., cases in which the frontal portion

of the mandible is markedly lacking in normal conformation, the mental protuberance being deficient almost to the point of absence. In Fig. 12, a girl ten years of age, the need is less marked than that in Fig. 13, a boy nine years of age, and it will be interesting to note that in the latter instance the favorable growth ensued far more rapidly than in the former. In Fig. 14, a girl eight years of age, growth response was rapid during the first year of treatment, and less rapid during the interim which followed.

In carrying forward the study of cases in which marked deficiencies in mandibular growth are manifest at the time treatment was started, it is also of interest to analyze cases in which serious dental anomalies exist, and yet the mandibular structures lie within the range of the normal. In subjecting many of these to the analysis which has been described, it has become apparent

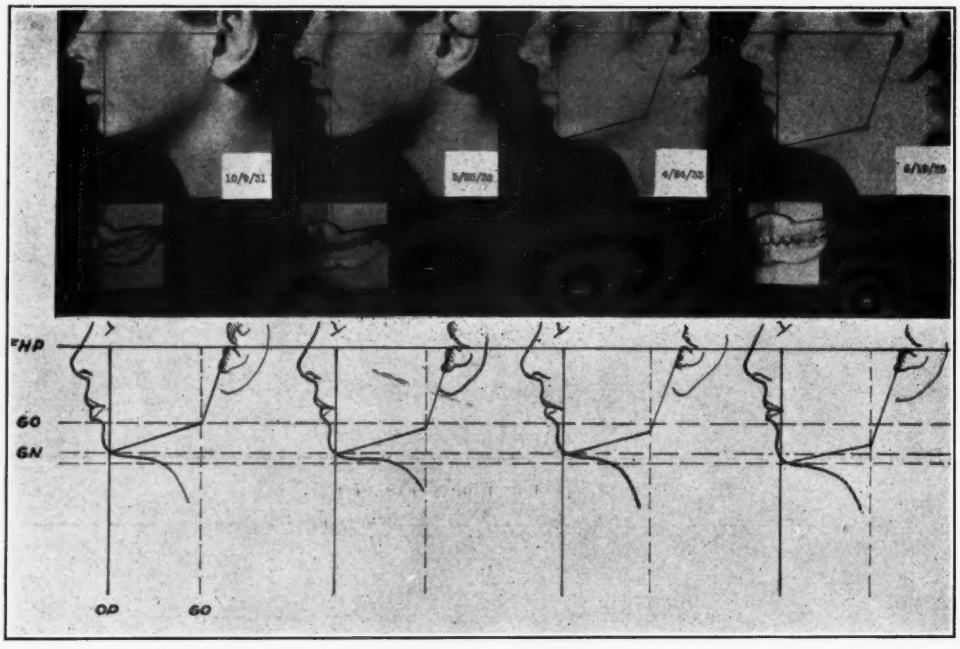

Fig. 15.—A girl ten years of age. In studying this, and the two illustrations which follow, it will be noted that while growth changes are evident, the "mandibular pattern" did not change.

that while growth increment is evident throughout the facial structures, it follows the patterns already established in the mandible and its dependent structures. As an example, your attention is called to Fig. 15, a girl ten years of age, at the time orthodontic treatment was undertaken. Growth in a vertical direction, up to the time of the last record, seems to be the change most clearly demonstrated, with, of course, an improvement in the mentolabial sulcus, resultant upon the correction of the dental anomaly. In Fig. 16, a boy eight years five months of age, and Fig. 17, a girl twelve years of age, this same growth behavior is manifest.

All the changes noted in these cases are in keeping with Wolff's law which, in its briefest form, states "that bone growth occurs where there is a need for it." We have not required verification of this principle in orthodontics, so far as changes in the dental arches are concerned, for every clinician of ability

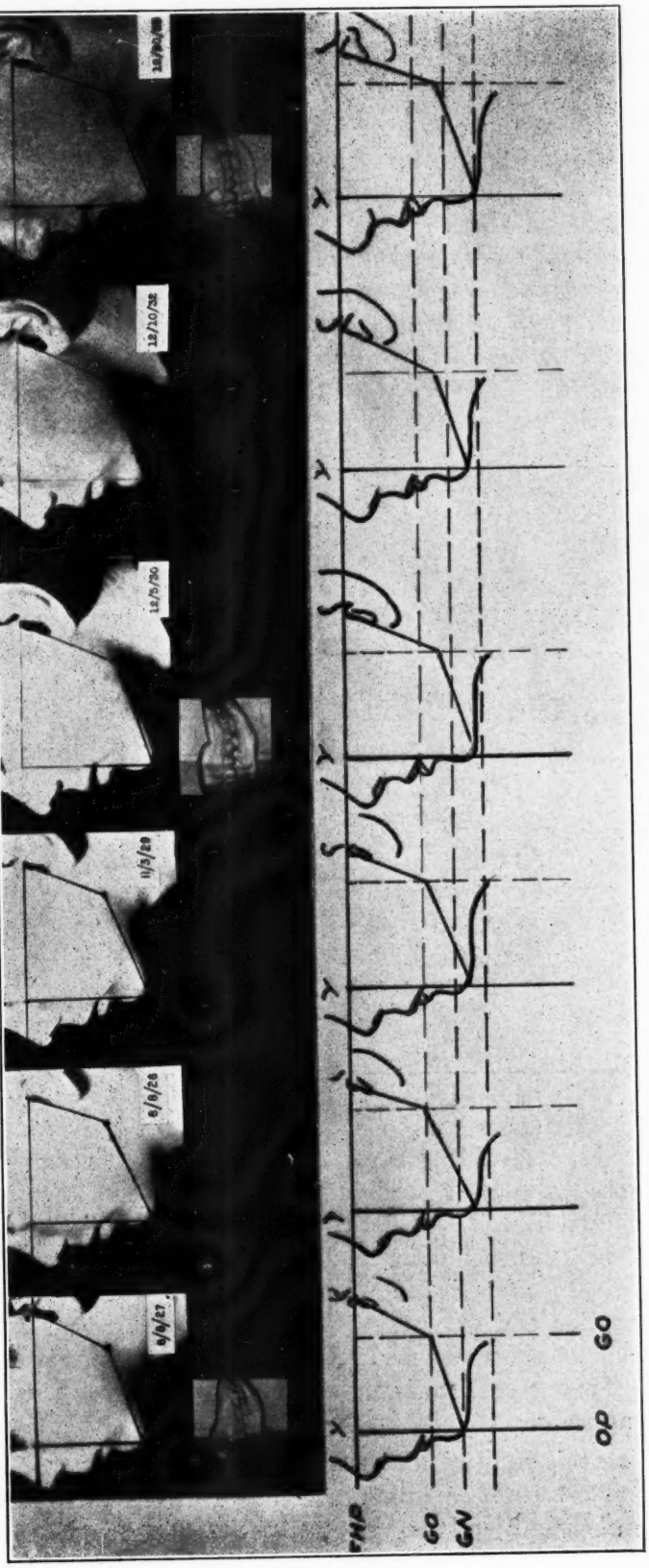

Fig. 16.—A boy eight years and five months of age.

has proved this time without number. What we have needed is evidence to controvert the assertion still made by many that "you can change the teeth but not the jaws."

Any discussion of this character naturally elicits an interest in methods of treatment. It is such studies in fact which demonstrate the need of all our available knowledge of therapy and the application of each helpful principle in meeting individual problems. This paper, however, is not concerned with methods of treatment; therefore the question of technic will not be injected into it. Suffice it to say that when and where needed, treatment has included the usual agencies of applied mechanics; those fundamental means of stimulating the growth impulse available in myofunctional therapy; the overcoming of nutritional deficiencies; the correction of malfunction in such adjacent structures as the nose and throat; the establishment of correct bodily posture, and such other

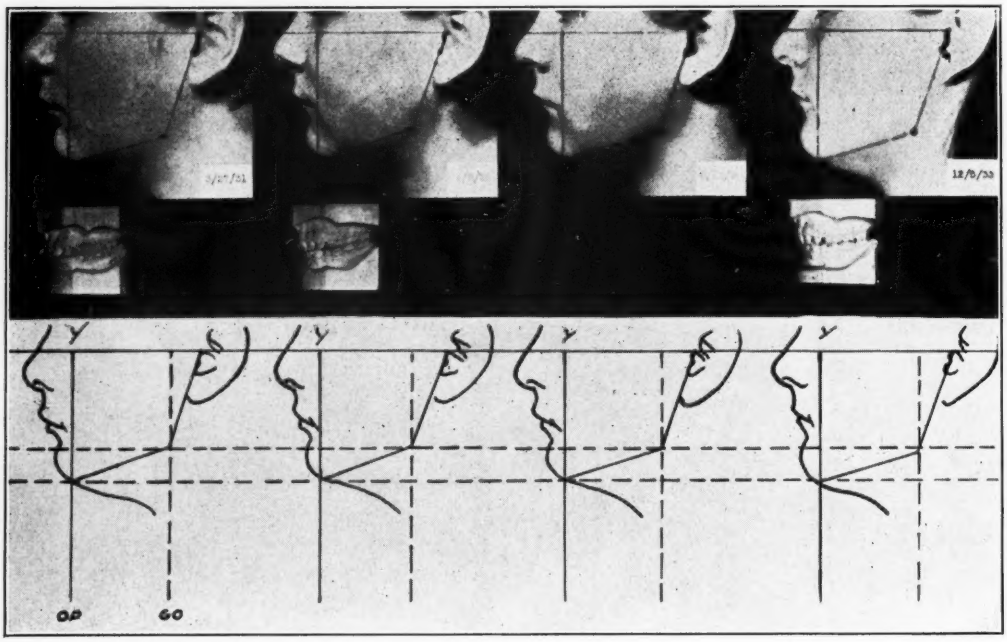

Fig. 17.—A girl twelve years of age.

factors as have been essential to favor the progress and permanency of orthodontic operations. As early as possible, necessary tooth movements, dental arch alterations, the establishment of dento-intermaxillary relations of advantage were brought about, and such other measures taken as would establish the teeth and jaws within the normal functional range. The time-worn physiologic axiom that "function and growth go hand in hand" has been fully utilized; but, when applied, an effort was made to encompass more than mere dental and cuspal function, for our problem is one of supplemental growth, and the factors effecting it are numerous.

In presenting this study, it was made clear at the outset that we were considering the specific type of dysgnathic deformity in which the mandible is arrested in its development, and frequently malrelated to its adjacent structures. It will be obvious that other studies of the mandible may be of equal importance,

particularly those where definite overgrowth occurs. Such deformities are less frequent than those we have discussed, but because of the difficulties encountered in the control of such cases, their study offers a verdant field of research which we hope will continue to receive the attention of skilled investigators.

When we consider the far-reaching ill effects of the deformities we are called upon to alleviate, it becomes increasingly difficult to understand why the vast majority of laymen, and far too many dentists, still assume an indifferent attitude toward the problem. Doubtless to such it is still a "tooth problem," no more, no less. This lack of comprehension will undoubtedly always remain one of our chief handicaps, for successful treatment must stand upon a dual foundation, with the skilled efforts of the orthodontist on the one side and the faithful cooperation of patients on the other. Without these combined efforts, partial or complete failure stands in the offing. We know the full magnitude of the task which confronts us, and the limitations under which we must work. We also sense the gratifying fact that as a result of our striving, the lives of many children are made brighter, happier and more healthful. We must take courage, therefore, and carry on, and so direct our efforts that the scope and achievements of the healing art will be more fully extended.

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PHONETICS IN ORTHODONTIA

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THE value of the teeth to one's personal appearance and their value as a masticating apparatus for our well-being, are always present in our minds, but their value and function in speech have not been so clearly brought to our notice. I therefore venture to submit these few remarks on phonetics in an attempt to show how the teeth play their part in speech.

In most cases of malocclusion the position of the teeth is such that it is impossible for the lips and teeth to function normally in speech, but after correction the interference is removed and the lips usually function normally on the teeth. There are cases, however, in which this does not occur, and it is here that I have found a resort to phonetics helpful. Further, we must remember that it is the normal functioning of the lips on the teeth which helps to retain the corrected cases.

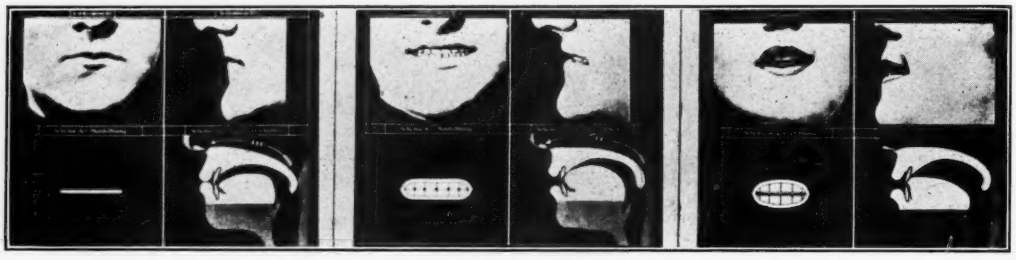

Fig. 1.

We are of course interested only in that part of phonetics which deals with the movements of the tongue and the lips on the teeth.

The first chart in Fig. 1 demonstrates the lip consonants. They are *M, P, B.* These are the first articulate sounds made by the child before he gets his teeth, as "mama," "papa," "baby." Here the arches are in their normal antero-posterior relation, and the tongue lies dormant and merely guides the air on to the lips—the lips do the work. It will therefore be seen that a person with protruding teeth cannot bring the lips closely enough together to pronounce these sounds in the natural manner.

A good lip exercise is to hold the upper lip down over the teeth with the finger, while repeating the phrase: "Speak with your lips," and the words "plum, whispers," speaking softly, almost inaudibly; thus emphasizing the action of the lips at the expense of the vocal cords, as though the latter were paralyzed.

The second chart in Fig. 1 shows the *N, T, D.* Here we have teeth consonants. The mandibular arch is brought forward with the teeth in such a position that the tongue can release the air with force onto the teeth, and the lips

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are only slightly open, as in the words "to do." Here the exercise given is the phrase: "To do his duty," and in order to accentuate the use of the teeth, the patient brings the mandible forward and speaks through the teeth as though angry.

The third chart in Fig. 1 shows the *th*. Here the mandibular arch is brought still farther forward, until it is in quite an anterior position. The tongue is held tightly between the teeth, and then it is suddenly withdrawn, releasing the air onto the maxillary teeth as in "the, mother, nothing."

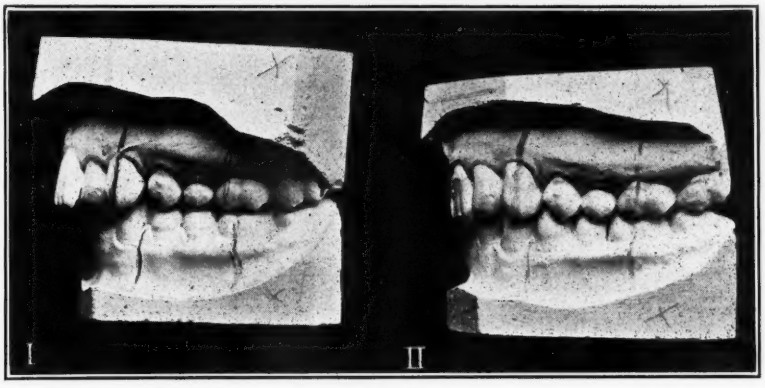

Fig. 2.

Fig. 3.

As is seen from the chart, the *th* exists only in the English language. I have heard a Frenchman maintain that the constant pushing of the tongue against the teeth in the pronunciation of the *th*, was the cause of the characteristically protruding teeth of the English.

These charts have been selected out of the phonetic series and placed together, in order to show more clearly how far the mandibular arch comes forward in speech. You will at once appreciate the importance of this factor in our attempts to perpetuate the correction of postnormal occlusion.

It will be found in some postnormal occlusion cases after correction, that the mandibular arch will be in its normal forward position when the patient closes

the mouth, but on opening the mouth and speaking, the mandibular arch slips slightly back into a posterior position, that is, the patients do not speak with the chin forward, and are therefore unable to use their lips. In such cases it is necessary to help the patient to overcome this faulty habit by drawing attention to phonetics, showing how the lips and the teeth function, and by giving exercises.

Fig. 2 shows the models of a bilateral, postnormal occlusion case which I am using to demonstrate this point.

The first photograph in Fig. 3 shows the mouth closed with the arches in their corrected position.

The second photograph of Fig. 3 was taken to show how the mandibular arch comes still farther forward when speaking the *th* as in *the*.

The third photograph in Fig. 3 was taken to show how the patient, when speaking animatedly, lets the chin slip back into a slightly posterior position and therefore does not use the lips.

Fig. 4.

The way to correct this faulty habit is to get the patient to maintain constantly the forward position of the mandibular arch, as in the second photograph of Fig. 3, by urging her to speak constantly through her teeth, accentuating the use of the teeth consonants and speaking as though she were angry—for in anger the normal reaction is to throw the chin forward, and to children I say, "Speak like a gangster, as though you wish to frighten one."

This is, of course, in combination with the Roger muscle exercise, which stretches the internal pterygoid.

We must go a step further still in these cases, and teach the patient to smile instead of laugh—for in laughing the chin slips back into a posterior position. Therefore the patient must learn to smile, but to smile with the lips closed, without showing the teeth at all—a restrained smile; to children I say: "Smile like a Cheshire cat."

Fig. 4 illustrates this. The first photograph in Fig. 4 shows a broad smile, showing the teeth, and you can see how the chin has fallen back.

The second photograph in Fig. 4 shows a broad smile with the lips closed, covering the teeth—a restrained smile—the chin forward, and the pressure exerted on the teeth by the lips can be clearly seen. Through constant repetition of this exercise, the patient gradually becomes lip conscious.

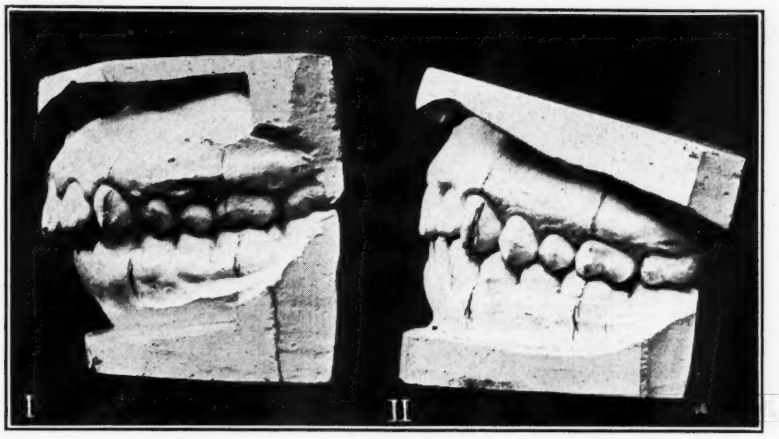

Fig. 5.

Fig. 6.

There is another type of case in which the position of the lips alone remains faulty after correction.

Fig. 5 shows the models of a unilateral postnormal occlusion case which I am using to demonstrate this.

Fig. 6, photographs I and II, show that, although the correction of the irregularity has brought the teeth into their normal position, the lips still remain open even when the patient is at rest.

Photographs III and IV clearly show the strain necessary to keep the lips closed. Here mouth-breathing is the root trouble, and there is usually, in such cases, some obstruction in one of the nasal passages, that is, the patient can

Fig. 7.

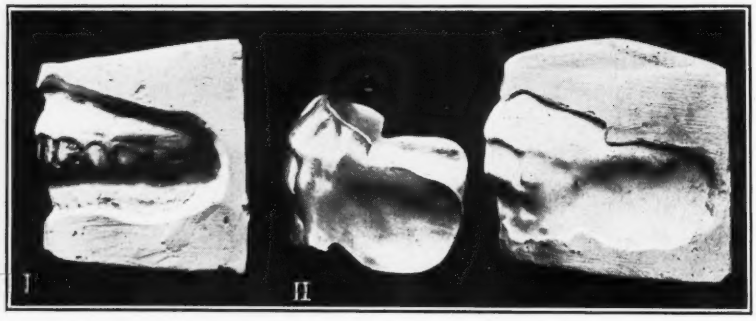

Fig. 8.

breathe better through one than the other. It can be seen clearly in photograph I that the right side of the nose is the well-developed side.

The patient should do deep-breathing exercises with the lips closed, holding closed with the finger the nostril of the well-developed side, and forcing all the air through the undeveloped side. He should in time be able to develop this side so that air can pass through as freely as on the well-developed side.

Then, to get the lips to function normally in speech, the patient should hold the upper lip down with the finger, as shown in Fig. 7, and practice the lip consonant exercises, and so accentuate this exercise that he feels the lips touch each other in speaking.

Another lip exercise is to draw the upper lip down with the fingers, holding it firmly between the teeth (biting the upper lip), while breathing deeply ten times. This exercise also draws the nose down and develops it, and the philtrum, or "cupid's bow," becomes more definitely marked.

All the foregoing exercises the patients are required to practice ten times a day, repeating them ten times at each practice.

In these cases, as in open-bite cases, the patients breathe through their mouths when asleep, and here the patient can also be helped.

Fig. 8 shows a breathing shield which, worn at night, forces the patient to breathe through the nose. It is made of aluminum, swedged from a model of the teeth in a closed position, with the prominence of the central incisors and canines slightly relieved by tinfoil, and the spaces between the teeth filled with wax.

This shield is inserted in the mouth after the patient gets to bed, and it forces him to develop nasal breathing by preventing him from getting any air at all through the mouth.

To conclude, I would submit that, although mechanical orthodontia concentrates purely on the restoration to the normal of the bony arches and teeth, it must always be remembered that our work does not stop here; for, however perfect, the results lack life until the living muscles which clothe and animate the bony mechanism have been persuaded to play their part normally.

A STUDY OF DIMENSIONAL CHANGES DURING GROWTH AND DEVELOPMENT OF THE FACE*

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THE most striking point in the skull at birth is the insignificance of the face;[1] hence any measurement of the face in the years that follow can reasonably be expected to show some very interesting changes.

The primary purpose of this survey is to show, so far as the material permits, the time and the rate of morphologic changes, if any, that occur during the growth and the development of the face. The survey was made on a collection of skeletal material in the University of Michigan Museum of Anthropology, secured by Dr. Carl Guthe in the Filipino Reconnaissance Expedition to the Philippine Islands during 1926.

After discarding deformed and obviously pathologic specimens, the available material consisted of fifty-seven Filipino skulls and one hundred mandibles, taken from burial caves in the Islands of Samar, Davao, Caraga, Surigao, Camotes, Southern Bohol, Daram, Siquijor, Mindanao, Masbate, Palawan, and Calamianes. Associated articles, according to Dr. Carl Guthe, date the material to the ninth or tenth centuries A.D. Although lacking in ages under six years, the material fits the purpose of this survey admirably, as a considerable number of a distinct human type at various age levels are represented. Furthermore, the teeth are very well preserved, much better than those of more recent and more civilized people.

Excluding specimens with deciduous dentitions only, and edentulous cases, the group, as a whole, showed but fourteen mandibles holding any carious teeth; in all, only twenty-one carious teeth were found, making the percentage of caries present less than 0.75 of 1 per cent. The degree of attrition indicated the use of coarse food. The habit of chewing betel nut left a stain on the teeth. Some malocclusion occurred, but, inasmuch as the jaws were not articulated, no accurate group classification can be given. Anterior crowding, however, was rare; not a single case of contracted palate was found; ten cases with congenitally missing premolars occurred, and about 10 per cent showed either unformed or partially impacted third molars. Keith[2] has stated that in about 30 per cent of Europeans the third molars do not erupt. Observing the mental foramen's location, it is interesting to note that it occurs at least one tooth posteriorly than in Europeans. The position of the mandibular foramen with respect to the third molar varies widely. In this group, at least two-thirds lie either on a level with or below the occlusal plane of the crown of the third molar.

For the purpose of classification and study, the material was grouped according to the development of dentition, a base common to all. Chronologic

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age and sex were disregarded as being too likely to increase the difficulty of establishing common groups. The development of dentition is a physiologic one and is closely associated with other manifestations of physical phenomena.[3]

The stages of development decided upon are eight, classified as follows:

I. The period in infancy before completion of the deciduous dentition.
II. The period at the completion of the deciduous dentition.
III. A group showing erupting and completely erupted permanent first molars.
IV. A group showing erupting and completely erupted second molars.
V. A group in early maturity showing erupting to completely erupted third molars.
VI. A group of adults in maturity showing the wearing of the cusps to the grooves.
VII. A group in old age showing crowns worn through the occlusal grooves and some teeth lost.
VIII. A group in advanced senility showing total loss of teeth.

The distinction made by I, II, III, IV, V (Hellman[4]) can be applied to any race, although VI and VII are not so readily applied to our civilized peoples, as the coarse diet enjoyed by the Indian and the Filipino is not common today.

Having thus established a definite stage in dentition and development, we can continue. Keith,[2] for example, gives tooth eruption as follows for whites (dark-skinned races a little earlier):

6 years as the average age of eruption for first molar;

12-14 years as the average age of eruption for the second molar;

18-21 years as the average age of eruption for the third molar.

Deciduous dentitions are generally completed within the first two and one-half years. The first deciduous tooth erupts around six months of age.

Stage development levels may be expressed in approximate age averages as follows:

III. 4.5-6 years
IV. 11-13 years
V. 18-25 years
VI. 26-40 years
VII. 41-55 years
VIII. 56- years

Sex was disregarded. According to Huber's edition of *Piersall's Anatomy,* no marked sexual difference in skulls exists up to puberty. In adult life, there is no difficulty in recognizing a *typical* skull of either sex, but in many cases the decision is difficult and sometimes impossible. Humanity[2] acquires new characters by retaining those which are infantile. Furthermore (Keith[2]), in passing from infancy to adult years, jaw growth gains rapidly on brain

expansion. The highest ratio, brain to palate, occurs during infancy and falls rapidly thereafter. Skeletal weight of both sexes is greatest from 25 to 45 years.[1]

The foregoing observations point to a change in proportion by an adjustment in form. All this furnishes evidence that the human face is not static but is undergoing constant change although at a greatly diminished rate. It is interesting to note that metabolic rates change very markedly at various age levels. The problem here is one which involves bone.

Inasmuch as the problem in this study involves more than just weight or observations, measurements in three dimensions plotted against time have been made in order to show proportional changes and the rate of growth. The developmental stages outlined constitute the time factor. The three dimension measurements (some sixty-seven in all) were taken using standard anthropometric methods and landmarks wherever possible. These were supplemented by others. Inasmuch as the material consists of disarticulated mandibles and crania, each type of measurement is made for every stage, listed and graphed separately, some sixty-seven in all.

From these measurements, figures are made up showing, collectively, heights, widths, depths, angles, and position of points on the facial mask.

The measurements made are as follows:

HEIGHT MEASUREMENTS ON MANDIBLES

1. Symphysial height (1), from the highest point on the inferior prosthion between the mandibular central incisors to the menton.

2. Mandibular height (right) (2); mandibular height (left) (3), down from the highest point on the interalveolar septum just distal to the first molar.

3. Ramus height, coronoid (right) (8); ramus height, coronoid (left) (9), from the tip of the coronoid process perpendicular vertically, to a line horizontal with the base of the body of the mandible.

4. Ramus height, condylar (right) (10); ramus height condylar (left) (11), from the superior surface of the condyle, perpendicularly downward to a line horizontal with the base of the body base of the mandible.

5. Sigmoid notch depth (right) (12); sigmoid notch depth (left) (13), from a line touching the highest points on the condyle and coronoid tips to the deepest point in the notch.

MEASUREMENTS OF ANGLES ON MANDIBLES

6. Gonial angle (14), the angle made by a line horizontal with the mandible body base, intersecting a line parallel with high points on the posterior surface or edge of the ramus and condyle; taken on a goniometer.

7. Alveolar menton angle (15), taken with the goniometer, using mandibular body as one line and the other laid from the highest midpoint of inferior prosthion to the point of the menton.

8. Menton angle (16), on the goniometer from the angle formed by the intersection of a line laid to the base of the alveolar process to menton and the horizontal mandibular base line.

DEPTH MEASUREMENTS ON MANDIBLES

9. Ramus maximum breadth, depth (right) (4); ramus maximum breadth, depth (left) (5), taken with calipers measuring the greatest distance between the most anterior surface of the coronoid and a line from the most distal surfaces or edges, of the posterior surface of the ramus to gonion.

10. Ramus minimum breadth (right) (6); ramus minimum breadth (left) (7), taken with calipers measuring the minimum distance between the anterior and the posterior surfaces of the body of the ramus.

11. Condylar menton depth (17), taken with calipers measuring the greatest distance between menton and a line against posterior surface of both condyles.

12. Condylar prosthion (18), taken with the calipers measuring similarly from both condyles to the most anterior superior part of the inferior prosthion.

13. Menton gonion (19), taken with the goniometer measuring the greatest distance between menton and gonion by the use of perpendicular lines intersecting the horizontal mandibular body base.

14. Menton condylar (20), taken with goniometer, measuring the greatest distance between condyles and menton by the use of perpendicular lines from these points to mandibular horizontal body base.

ALVEOLAR ARCH DEPTH MEASUREMENTS

Owing to the postmortem loss of many teeth from their sockets, measurements here were taken from alveolar distal margin in all cases.

15. Alveolar arch depth, from prosthion to second premolar (deciduous second molar in Stage III) (21), taken in a direct line from the most anterior part of the inferior prosthion to a line drawn across the mandible at the level of the distal margin of the above named alveoli.

16. Alveolar anterior depth, prosthion to first molar (22) taken the same way.

17. Alveolar arch depth, prosthion to second molar (23) taken the same way.

18. Alveolar arch depth, prosthion to third molar (24) taken the same way.

19. Symphysial thickness (25), taken with calipers, points placed perpendicular to horizontal mandibular body base line taking care to keep off the menton spines on the posterior surface of the mandible body in the anterior.

WIDTH MEASUREMENTS ON THE MANDIBLE

20. Bicanine minimum alveolar arch width (26), taken between the most prominent alveolar point between the canine and the premolar.

21. Alveolar arch width distal to the second premolar (deciduous second molar in Stage III) (27), taken from the widest alveolar arch distance as shown by buccal margins of the aforementioned alveoli.

22. Alveolar arch width (28) distal to the first molar.

23. Alveolar arch width (29) distal to the second molar.

24. Alveolar arch width (30) distal to the third molar (22, 23, 24, taken as directed for 21).

25. Bigonial width (31), between the gonial points of the mandible.

26. Bicondylar width (32), between the external extremities of the condyles.

MANDIBULAR BODY WIDTHS

In every case, calipers were placed perpendicular to the horizontal base line at a line parallel with the distal margins of the tooth alveolus named.

27. Mandibular body width distal to the second premolar (deciduous second molar in Stage III) (33).

28. Mandibular body width, distal to the first molar (34).

29. Mandibular body width, distal to the second molar (35).

30. Mandibular body width, distal to the third molar (36), at a point just parallel with the most anterior ramus portion.

HEIGHT MEASUREMENTS OF THE CRANIUM AND FACE

31. Nasion superior prosthion height (37), taken from the nasion to the most inferior point on the superior prosthion.

32. Anterior nasal height (38), from the nasion to the lowest point of the anterior margin of the floor of the nose.

33. Palate height (39), from a line taken at the top of the interalveolar septum between the second molar and the third molar on both sides, to the highest point in the palate.

34. Subnasal height (40), from the anterior margin of the floor of the nose to the superior interalveolar point.

35. Posterior nares height (41), from the base of the vomer to the posterior margin of the palate bone.

DEPTH AND POSITIONS ON THE FACIAL MASK

(The latter taken with Hellman's headspanner)

36. Porion to superior prosthion (42), from the external auditory meatus by the most direct line to the most anterior point on the superior prosthion.

37. Porion subnasal (43), taken in the same way to the subnasion.

38. Porion nasion (44), taken in the same way to the nasion.

39. Porion glabella (45), taken in the same way to the glabella.

40. Porion bregma (46), taken in the same way to the bregma.

41. Porion posterior palatine (47), taken in the same way to the posterior border of the palate.

FACIAL DEPTH ONLY

42. Total palate depth (48), from the anterior margin of the anterior palatine fossa to a transverse line on the palate plate of the palate bone indicating the nearest points of the posterior border.

43. Anterior palate depth of the maxilla (49), from the same anterior point to the transverse suture of the palatal processes of the maxilla and the palate bones.

44. Posterior palatine depth (50), the width of the palatine process of the palate bone.

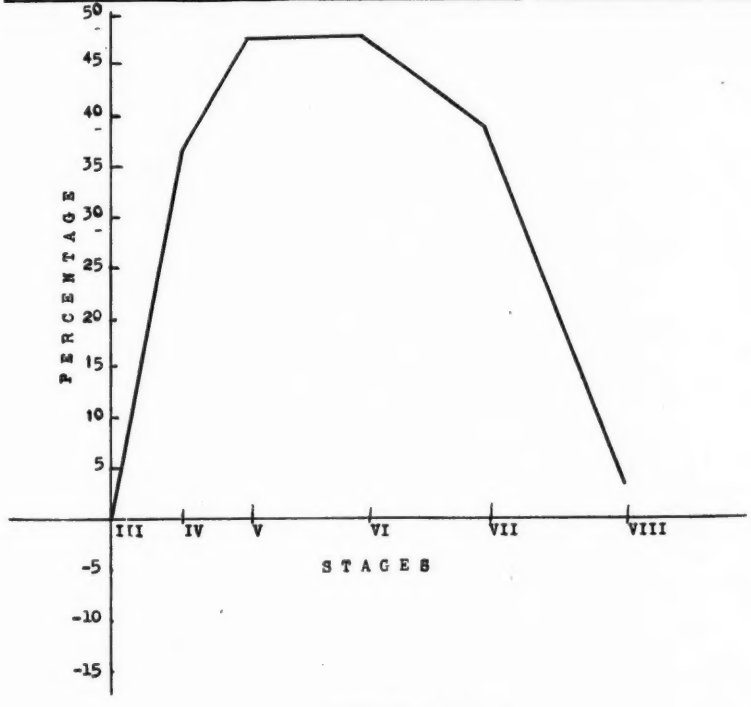
45. Maxillary arch depth (53), superior prosthion to the distal margin of the alveolus of the third molar.

46. Total alveolar bone depth (54), superior prosthion to palatomaxillary suture.

Table 3

SHOWING CHANGE IN MANDIBULAR HEIGHT (LEFT) OF MANDIBLE

Stage Number	Number of Specimens	Range Minimum and Maximum	Mean in MM.	Probable Error	Standard Deviation	Coefficent of Variation	Absolute Increase or Decrease in M.M.	Percentage Increase or Decrease Stage to Stage	Percentage Increase or Decrease from Stage III
III	4	17.0-20.1	18.28	---	---	---	---	---	---
IV	5	21.6-27.7	25.03	±0.75	2.23	8.91	6.75	36.9	36.9
V	16	22.0-33.1	27.03	±0.56	2.47	9.13	2.00	8.0	47.9
VI	31	22.2-35.8	27.07	±0.33	3.35	12.39	0.04	1.0	48.1
VII	35	18.1-33.0	25.44	±0.36	3.22	12.67	-1.63	-6.0	39.2
VIII	6	12.9-25.5	18.87	±1.23	3.67	19.42	-6.57	-25.8	3.2
Total for V-VI-VII	82	18.1-35.8	26.37	±0.28	3.67	13.92	---	---	



BASION DEPTHS

47a. Basion superior prosthion (51), taken from basion in a direct line to the anterior point on the superior prosthion.

47b. Basion nasion depth (52), from basion in a direct line to the nasion by means of the arc calipers.

WIDTHS OF THE FACE

48. Interorbital width (55), between the points of articulation of the frontal, maxillary, and lacrimal bones.

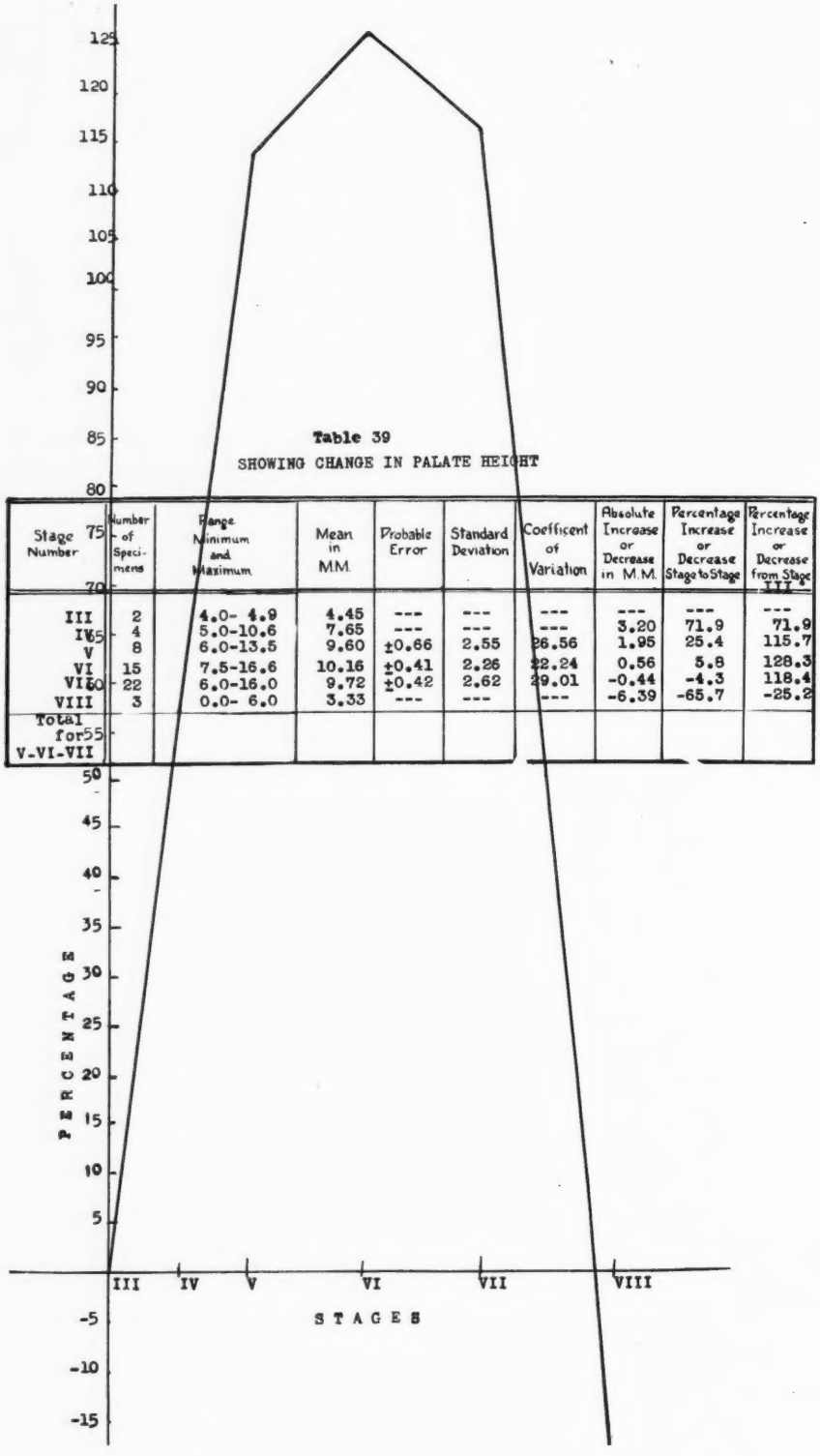


Table 39

SHOWING CHANGE IN PALATE HEIGHT

Stage Number	Number of Specimens	Range Minimum and Maximum	Mean in M.M.	Probable Error	Standard Deviation	Coefficent of Variation	Absolute Increase or Decrease in M.M.	Percentage Increase or Decrease Stage to Stage	Percentage Increase or Decrease from Stage III
III	2	4.0- 4.9	4.45	---	---	---	---	---	---
IV	4	5.0-10.6	7.65	---	---	---	3.20	71.9	71.9
V	8	6.0-13.5	9.60	±0.66	2.55	26.56	1.95	25.4	115.7
VI	15	7.5-16.6	10.16	±0.41	2.26	22.24	0.56	5.8	128.3
VII	22	6.0-16.0	9.72	±0.42	2.62	29.01	-0.44	-4.3	118.4
VIII	3	0.0- 6.0	3.33	---	---	---	-6.39	-65.7	-25.2
Total for V-VI-VII									

49. Bimalar width (56), between lowest points of the maxillary malar suture at the lowest point.

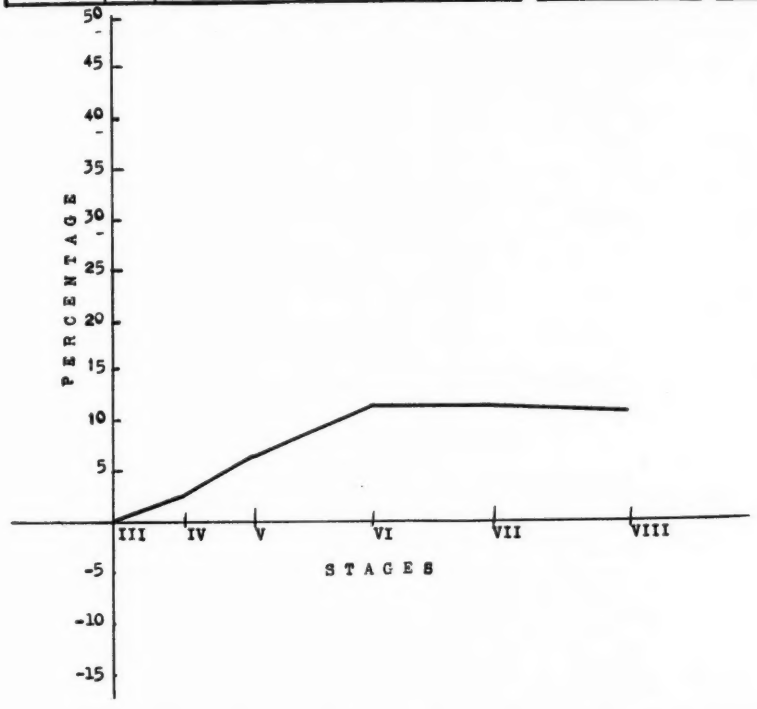
50. Bicanine width (minimum alveolar arch width) (57), between the most prominent points on the alveolus between the canine and premolar.

51. Posterior nares width (58), between the posterior margin of the anterior pterygoid plates about one-third above the palate.

Table 46

SHOWING CHANGE IN EAR (PORION) BREGMA DEPTH

Stage Number	Number of Specimens	Range Minimum and Maximum	Mean in M.M.	Probable Error	Standard Deviation	Coefficent of Variation	Absolute Increase or Decrease in M.M.	Percentage Increase or Decrease Stage to Stage	Percentage Increase or Decrease from Stage III's
III	1	105.2-105.2	105.20	---	---	---	---	---	---
IV	4	106.0-111.5	108.15	---	---	---	2.95	2.80	2.8
V	9	96.9-121.6	112.19	±0.52	2.20	1.96	4.04	3.70	6.6
VI	15	110.0-128.0	117.31	±0.78	4.34	1.70	5.12	4.60	11.5
VII	23	108.0-133.0	117.24	±0.25	1.73	1.48	-0.07	-0.06	11.4
VIII	5	110.5-121.5	116.14	±0.47	1.42	1.22	-1.10	-0.90	10.4
Total for V-VI-VII									



52. Anterior nasal width (59), between the lateral margins of the internal pterygoid plates about one-third above the palate.

53. Bizygomatic width (60), between the zygomata at their widest spread.

54. Maxillary arch width (61), at the maxillopalatal suture.

55. Minimum palate width (62), between the palatal margins of the canine alveoli.

56. Maximum palate width (63), between the alveolar margins distal to the second molar.

57. Maximum maxillary arch width (64), between the widest spread on the buccal side of the alveolar process.

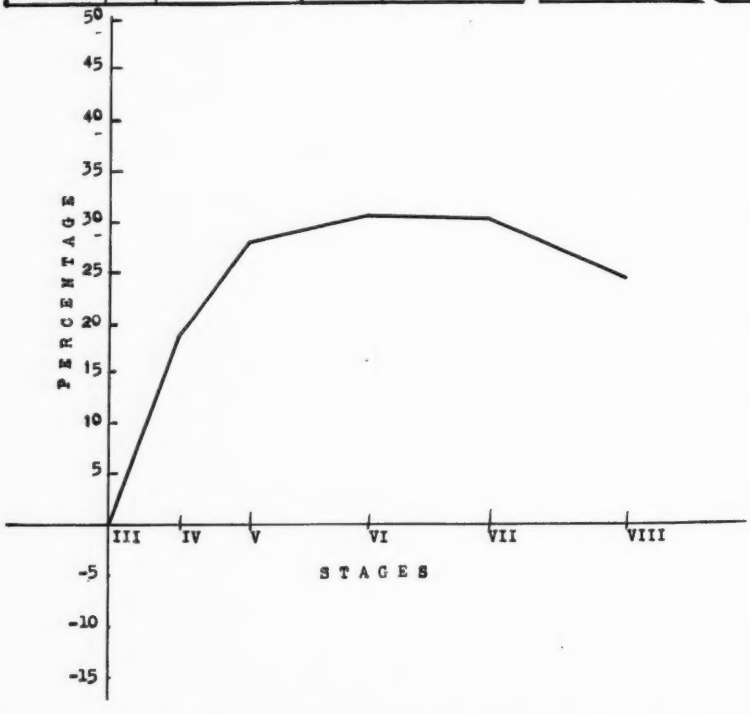
MAXILLARY ALVEOLAR ARCH WIDTHS

58. Distal to the second premolar (65).
59. Distal to the first molar (66).
60. Distal to the second molar (67).

TABLE 60

SHOWING CHANGE IN BIZYGOMATIC WIDTH OF FACE

Stage Number	Number of Specimens	Range Minimum and Maximum	Mean in MM.	Probable Error	Standard Deviation	Coefficent of Variation	Absolute Increase or Decrease in M.M.	Percentage Increase or Decrease Stage to Stage	Percentage Increase or Decrease from Stage III
III	1	102.6-102.6	102.60	---	---	---	---	---	---
IV	4	120.0-125.5	122.33	---	---	---	19.73	19.2	19.2
V	9	123.0-139.0	131.12	±1.23	5.11	3.90	8.79	7.2	27.8
VI	14	127.0-142.0	133.92	±0.81	4.31	3.22	2.80	2.1	30.5
VII	20	109.0-147.0	133.67	±1.49	9.68	7.24	-0.25	-0.2	30.3
VIII	6	119.0-132.0	127.40	±1.29	4.23	3.32	-6.27	-4.6	24.2
Total for V-VI-VII									



REGARDING MEASUREMENTS, DATA, AND GRAPHS

As indicated, the data were recorded and graphed in sixty-seven different tables, one for each measurement. Of these, Tables 3, 39, 46, and 60 are shown here in full for two reasons. First, they illustrate the method of recording and graphing the data; and second, these few are striking illustrations of the relative rate of change (increase or decrease) in dimension in different locations. Measurements involving alveolar bone only, increase and decrease most rapidly. For example, the graph in Table 39 involves alveolar bone entirely;

the measurements in Table 3, alveolar bone at one end; in Table 46, facial bone; and in Table 60, cranial bone. Referring again to these tables, each shows the number measured for each stage, the range (the smallest and largest measurement for each group); the average or mean, the probable error (ex-

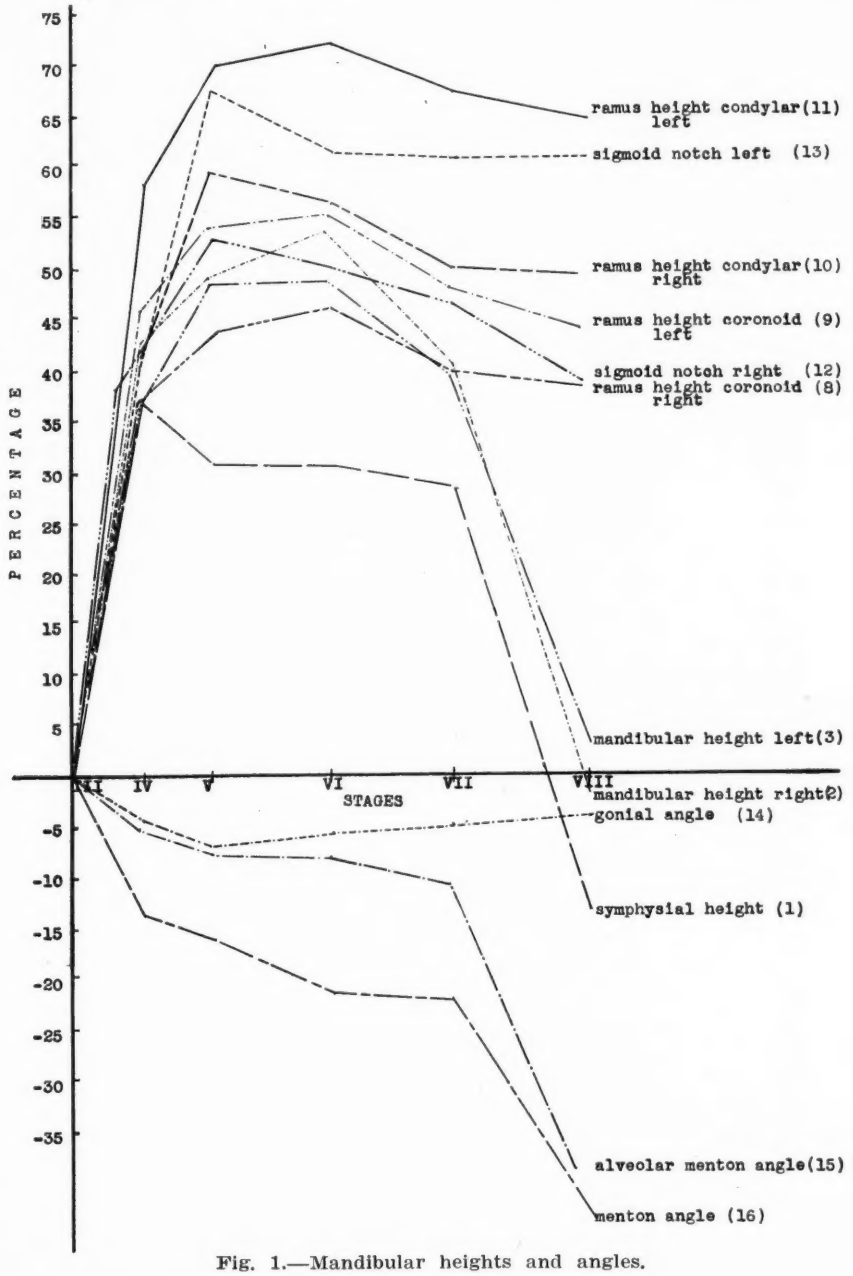


Fig. 1.—Mandibular heights and angles.

pressing the limit of the 50 per cent zone) through which we may determine by comparison with the actual difference in means, whether or not the difference is significant; standard deviation[5] (expressing the degree of concentration of variates around the mean point) helps us to measure the way in which sizes vary, and may, when necessary, aid in determining racial affinities;[5] and finally, the coefficient of variation.

The same data were also recorded for the mature groups of mandibles as a whole. In addition, for the purpose of giving an absolute measure from group to group (in this, a definite racial entity), the increase or decrease in millimeters is given. The latter is expressed in percentage, in the next column. In the last columns, the percentage increase or decrease from the youngest group as a base is shown. This last percentage is graphed, which gives us at a glance an instructive illustration of the actual process of development. It also shows the rate of growth of any given measurement. After the first few months of life, the rate of growth decreases.[2] These measurements show that this rate not only tends to decrease to a period of stability during later maturity, but finally during senility, the change becomes an atrophic or a negative one. The percentage growth, increase or decrease, has been plotted from group three, the youngest group (perhaps four and one-half to five years

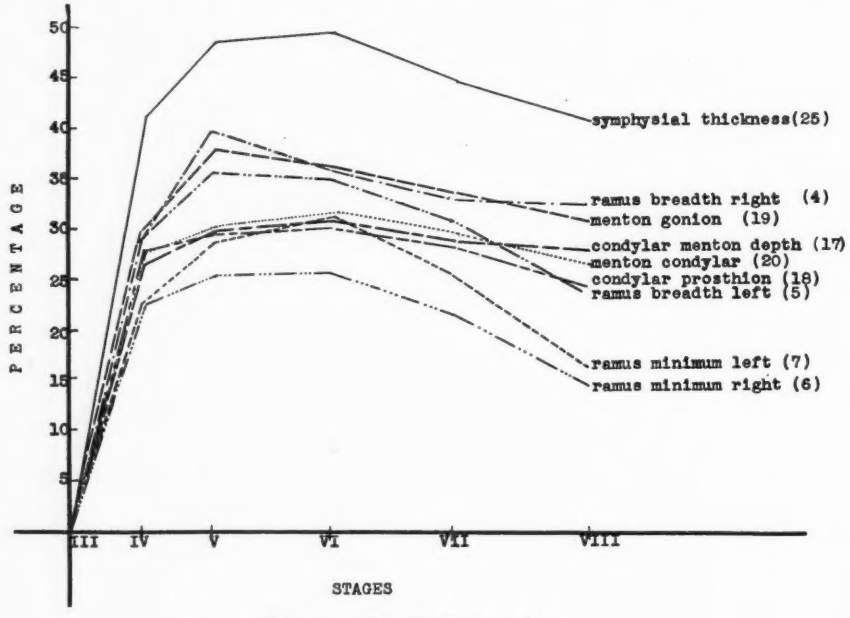


Fig. 2.—Mandibular depths.

of age), against time in order better to present clinically the developmental changes this survey is designed to show. In general, these changes will be shown to form a curve gradually rising to a peak in maturity then actually falling during senility. These graphs are all reproduced according to groups in the accompanying illustrations.

Some areas will be found to reach full growth much earlier than others. These will be pointed out as they occur. Clinically, exact knowledge of the time, rate, and maturity of growth at different places or levels would be of aid, not only in diagnosis and prognosis, but in treatment as well, in the correction of malocclusion or associated facial deformation. Measurements one through sixty-seven are graphed to show the percentage increase or decrease of growth from Stage III in the particular measurement named. Were there sufficient numbers, we might make some deductions as to the direction

in which evolution of size is taking if, as Keith[2] has observed, counting the number above the mean indicated the trend toward a larger or a smaller dimension.

Fig. 1 shows graph number 1 of symphysial height and a very rapid increase in height from Stage III to IV. In fact, it reaches maturity at this age, then actually decreases and remains more or less stationary for two developmental periods before falling away very sharply. This graph, in my opinion, shows the effect of early loss of anterior incisors through tribal custom inasmuch as the bone involved is largely alveolar process dependent upon holding a tooth; its premature disappearance is reflected in the graph. When we compare our graph with Hellman's observations,[4] we find that we might otherwise

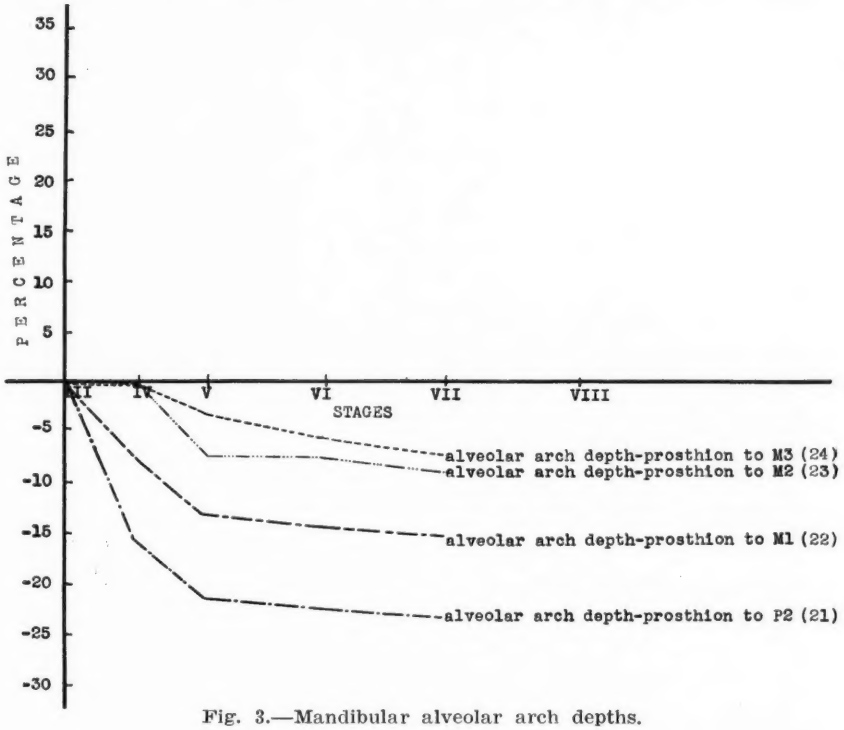


Fig. 3.—Mandibular alveolar arch depths.

have expected a gradual increase for another period. The fact that the height remained stationary until Group VI, old age (after the initial absorption), immediately tends to reconcile the two apparently conflicting results. Referring again to Fig. 1, the graph measurements, numbers 2, 3, 8, 9, 10, 11, 12, and 13 illustrate the manner of growth in height in different areas of the mandible. All show a rapid and significant growth from Stage III to IV, some a significant but less rapid growth from IV to V. From V to VI, measurements 2, 8, 9, and 11 show a slow increase, while 3 remains stationary and 10, 12, and 13 show a slow decrease in size. Comparing the rate to the upper, it is found that the growth of all parts of the mandible is more exuberant between Stage III and Stage IV than is the case of the upper with the exception of palate depth. As Hellman observes,[4] symphysial height seems to increase the slowest of all and to decrease more rapidly than in any other region excepting

the decrease in the molar region. Growth in the mandible continues until Stage V in all areas measured, and in many cases shows a slight increase from V to VI, from which there is generally a significant decrease which is very marked in VII to VIII in those areas involving alveolar process. While right and left show similar trends, growth on one side may be greater than on the other. Complete symmetry in growth is apparently rare. For example, ramus heights (Condylar), left and sigmoid notch depth left, and ramus height (Coronoid), left, exceed the right.

The graphs from Tables 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36 are shown together on Fig. 4. All involve width measurements. It is evident that bicondylar and bigonial widths rise rapidly to Stage IV, and continue slightly until Stage V, then slightly decrease, the bicondylar rate being

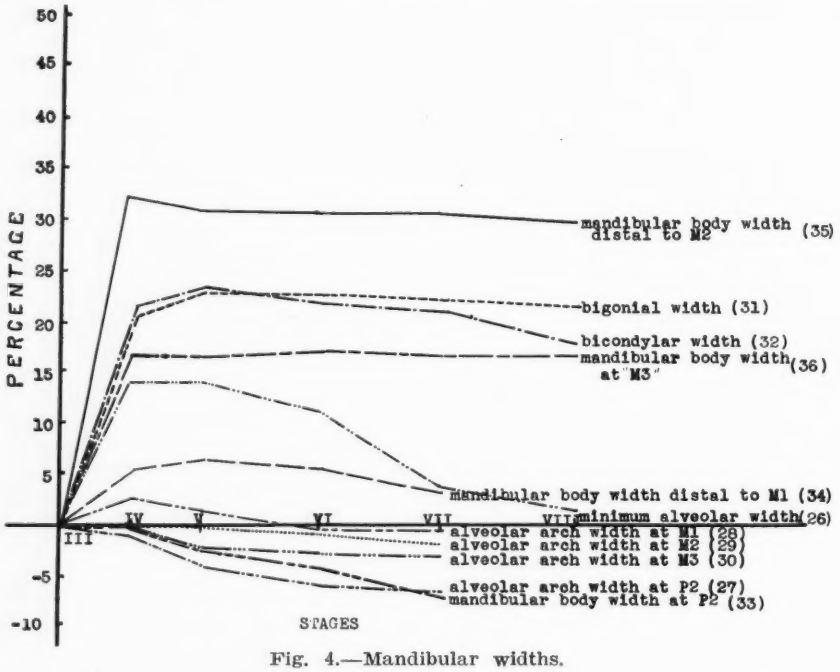


Fig. 4.—Mandibular widths.

slightly greater. The minimum alveolar width rises less rapidly from Stage III to IV, shows no significant change through IV, but falls rapidly from V, possibly due to the absorption of alveolar bone. The most striking thing about mandibular body widths is their stability, which increase in order, from before backward. At the third molar, or preramus region, no significant change from Stage IV is shown. Furthermore, the most exuberant growth occurs at the level of the second molar. Graphs 27, 28, 29, and 30 show changes in the mandibular body width at various growth stages. The most interesting condition shown is the lack of increase in width in the second premolar region; in fact, one must infer that the mandibular width at the distal margin of the second premolar is approximately as large at Stage III as it ever becomes in this region.

Referring to Fig. 4, Graphs 27, 28, 29, and 30 show alveolar arch width changes. At the level of the second premolar, arch widths slightly decrease

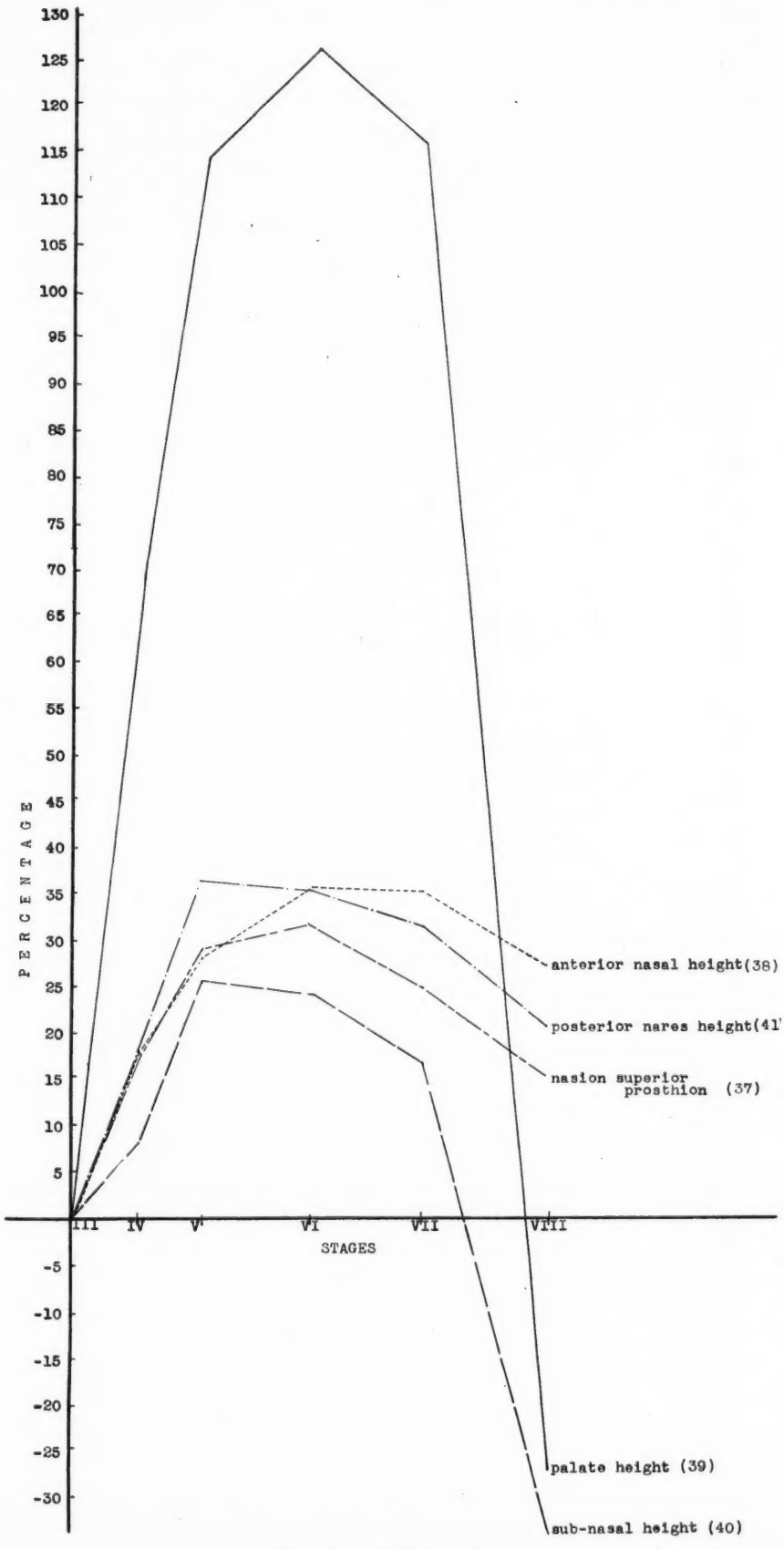


Fig. 5.—Facial heights.

from III to IV, then gradually decrease to senility, probably due to the difference in width of crowns of deciduous second premolars and second molars. Only at the first molar is there any increase from III to IV. Expanding the arch at this level may be interpreted as working in harmony with nature.

Turning to Fig. 8, and comparing the mandible with the upper face, it is evident that the course of bicanine width is not parallel to that of the lower

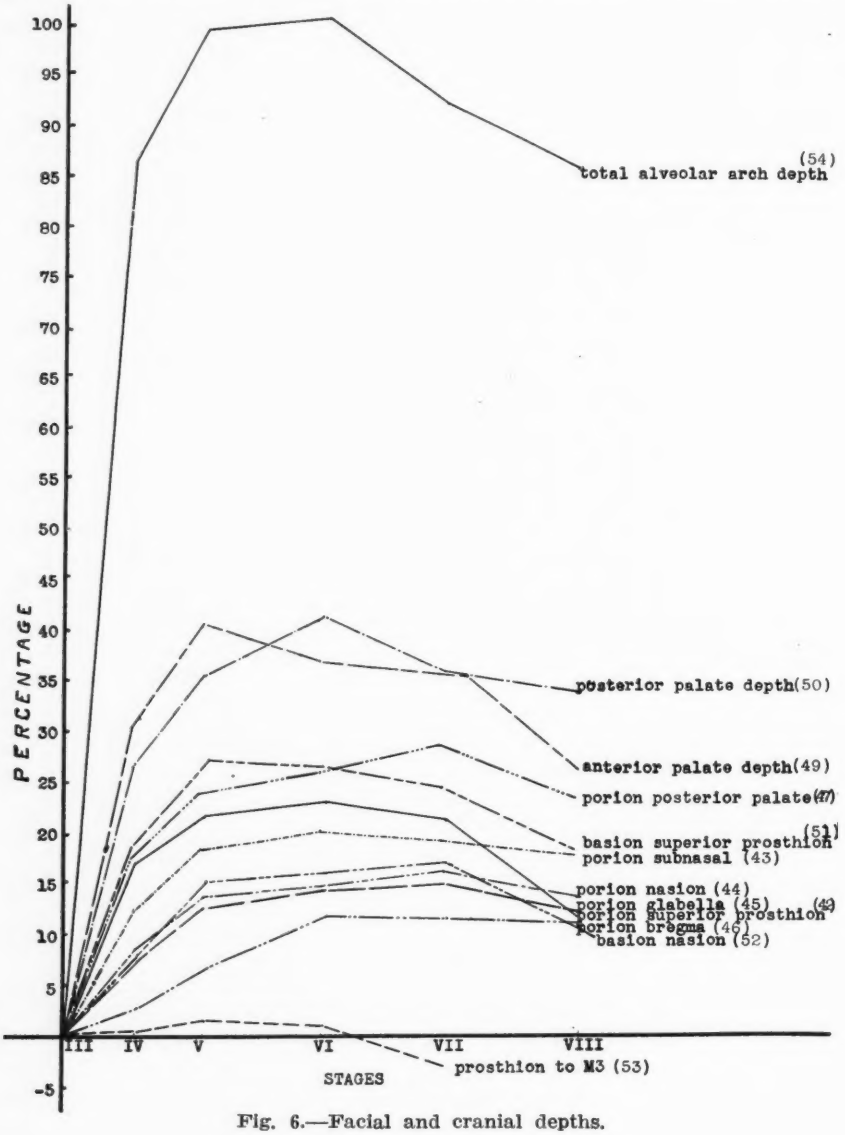


Fig. 6.—Facial and cranial depths.

during III to IV, but rises sharply only after reaching IV. I am personally of the opinion that a greater number of specimens in this group might alter this curve.

Width growth in the upper, between III and V, is most exuberant in the following increasing order: bicanine, maximum palate, anterior nasal width, bimalar, bizygomatic, and interorbital. With the exception of posterior and anterior nares, all mature at Stage VI. Posterior nares and anterior nares,

being space widths, would be differently influenced by a loss of bone.[1] The curve may be explained as sinus openings, by the absorption of the bony tables, thus permitting atrophy or absorption to increase greatly the size of

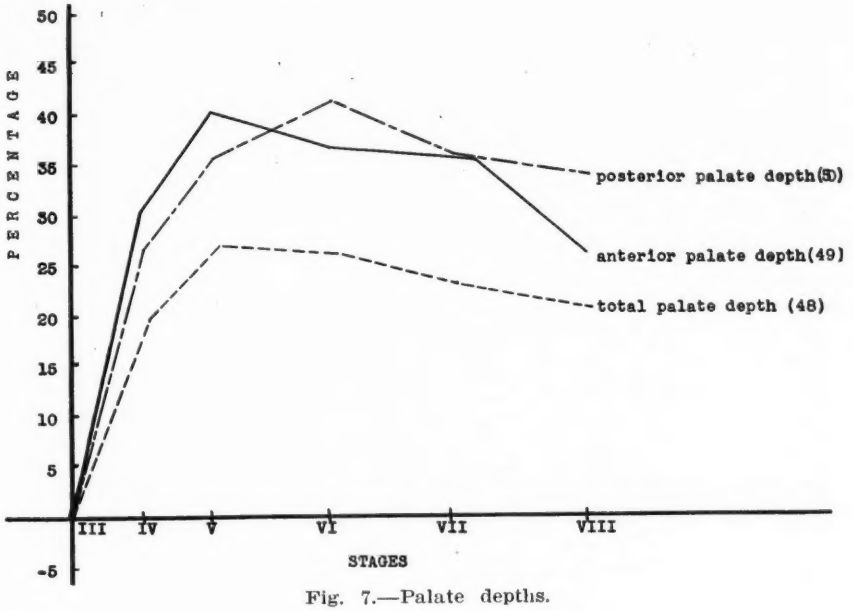


Fig. 7.—Palate depths.

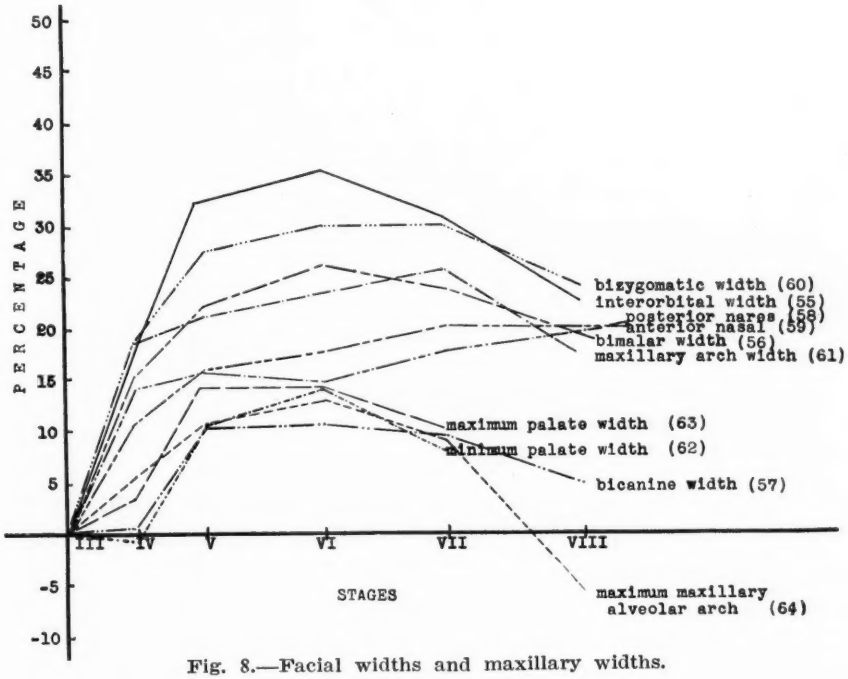


Fig. 8.—Facial widths and maxillary widths.

the aperture. The same theory would explain the drop in the posterior nares at Stage VI as any reduction in the outward swing of the pterygoid wing would reduce the aperture at first.

Fig. 9 shows the curve taken by maxillary alveolar arch widths at various levels. As with the lower, the second premolar is found to change the least.

The fact that these alveolar arch widths show a slight increase in dimension rather than a decrease as below, may be due to the fact that the uppers have a greater width of alveolar process labially and buccally from the teeth; consequently the measurements are not so soon affected by alveolar absorption.

Fig. 1 shows angle measurements as well as heights. The gonial angle decreases until Stage V and then becomes greater, approaching the angle in early life, as would happen with an increase or decrease in that region. Referring to Fig. 2, we find that the condylar menton distance is relatively stable but the gonion menton distance falls sharply from Stage V. The apparent absorption at gonion indicated would tend to make the gonial angle obtuse. The other two angles show a condition which one could anticipate if one of the two different landmarks approached the other late in life, eventually a like angle. As the edge of the inferior prosthion recedes to its base, the

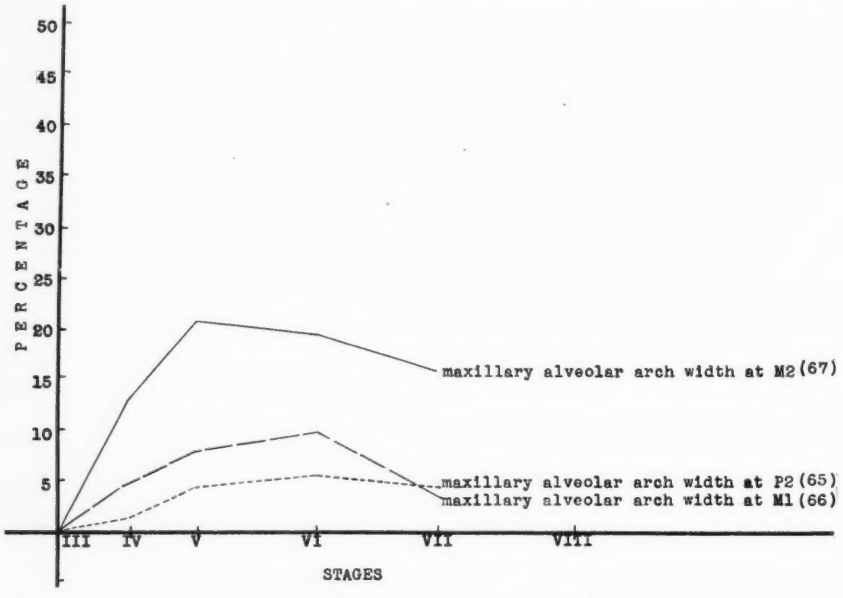


Fig. 9.—Maxillary alveolar arch widths.

angle resulting therefrom with the menton would tend to become the same. Seeing the space between the two angle lines, alveolar menton and menton, graphed in Fig. 1, the greatest difference should occur at maturity—and does.

I am somewhat at a loss to interpret the difference in curves of the bicanine width of the mandible and of the maxilla. Given normal occlusion and articulation of the teeth, it would seem that if the growth that took place in the mandible at Stage III were delayed in the maxilla until Stage IV, there would exist a disproportionate increase. On the other hand, related measurements in this case above, minimum palate and maximum palate take the same course as maxillary bicanine. In fact, the slight decrease in minimum palate width from Stage III to Stage IV is exactly what must happen if a larger tooth takes the place of a smaller one within the same or nearly equal external boundaries. The internal width from tooth to tooth is bound to decrease. Neither disharmony nor discrepancy exists here. It is quite possible, of course,

that had we available more and younger material of this race, we would find that a previous growth, possibly a very exuberant one, may have already taken place in the maxilla. At least, that it is the one place in the maxilla where even the most unobserving layman can note the spaces created between deciduous teeth as the jaw widens from Stage II to Stage III.

SUMMARY

In reviewing these measurements of this particular material one striking condition is apparent. In Fig. 2, carrying depth measurements, and in Fig. 6, carrying measurements from porion to various points on the facial mask, it can readily be seen that the percentage addition occurs at a faster rate on facial mask measurements from porion nasion down. In fact, the order of increase is thus: porion bregma, porion glabella, porion nasion, porion subnasal, porion prosthion. Porion posterior palate, showing the greatest percentage addition, does not exceed 28 per cent from Stage III; whereas total alveolus increases over 100 per cent from III to IV and gains sharply from IV to V. Even gonion menton does not increase over 38 per cent. From previous graphs it has been noted that the rapidity of growth seems to be slowest in width but is greater in height and in depth. That being the case, the distance measured from cranial porion represents readjustments in the facial mask rather than depth, and it is difficult to avoid the conclusion that the growth of the face is faster backward than forward. Or we may state that this internal growth from before backward is permitted by allowing the radii from porion to points on the facial mask to open up or spread, mainly downward. *No measurement recorded indicates any growth in senility.*

The facial changes shown are by no means the entire pattern in growth and development, but this outline of changes indicates that facial changes may be manifested in the following ways:

1. Growth in height.
    a. Attained by a moderate increase in the upper face and a greater increase in the alveolar process, its associated teeth, and ramus (see Fig. 1).
2. Growth in width.
    a. Attained by a small increase in a lateral direction in a plane near the anterior border.
    b. Attained at an increasing rate as the plane is moved posteriorly. For example, the greatest increase in the mandible appears between gonions and between condyles, intermediate amounts between them and menton. For instance, mandibular body width at the second molar. Above, the greatest increase in width is between the zygomata, the least between the canine regions.
3. Growth in depth.
    a. Attained by a marked anteroposterior increase in face dimension. For example, Figs. 2 and 6 show that the increase in palate depth must be made by addition at the posterior end as shown by graph

of palate alveolar process above, and mandible below. The anterior one-third of the maxillary arch assumes a change of arch form which permits no lengthening, rather a shortening. Unfortunately for this survey, the mandibles were not attached, but we may safely observe within the limits of the maxilla that the lower parts of the facial mask grow most rapidly.

4. An adjustment of facial position as mentioned.

5. By a modification of angles.

In these five ways, the manifestation of a very complex growth can be easily recognized and measured.

This study reveals a few interesting things as regards this material:

1. Apparently there are increases, periods of partial stability, and finally a gradual decrease in size.

2. The greatest change takes place in the posterior portion of the face, changing the line of the facial base (Keith) downward and forward.

3. Not all areas grow at the same rate or mature at the same time. Maxillary widths not connected with alveolar bone mature at VI; on the other hand, *not a single mandibular width matures later than V;* maxillary depths reach stability at VI, as do mandibular depths in about one-half the cases; mandibular depths though seem to reach stability one stage earlier, V; in general, the early exuberant growth previously commented upon seems to carry through the mandible as a whole and permit earlier termination of additive change.

4. The exuberance of growth in mandible body width is greatest in the second molar region. The bigonial is still greater.

5. Apparently the most stable area below, occurs in mandibular width (35), (36), just anterior to the coronoid process, an ossification center.

6. The depth growth is subject to less variation and matures at VI, while maxillary alveolar bone matures at Stage V, stable at Stage VI.

7. The facial mask measurements indicate a great readjustment in the lower face, thus coinciding with Keith and many others on the growth of the cranium. Speaking generally, one might say that a prognathus facial development takes places after III or IV, male or female.

The complexity of the entire process is such that one is deeply impressed with the fact that certain growth processes take place naturally without the aid of any appliance. Too much knowledge cannot be had of how these growth processes take place in health or disease, when treating malformation and malocclusion, if we are (1) to avoid treating at cross currents with nature, (2) to assess accurately kind and amount of structural modifications involved, (3) to determine accurately just when nature is in need of assistance, and (4) to be best prepared to take advantage of the direction of normal development and growth or absorption.

Close study of these measurements shows that the age factor in any field of dentistry cannot well be disregarded. For example, in periodontia, a moderate absorption of alveolar bone in early senility is in harmony with other skeleton changes as shown. At the same time, the most successful full

dentures, as I recall, are in the mouths of young or mature patients. The zealous efforts to slow up absorption in edentulous cases in senility may well be as fruitless as an attempt to sweep back the tides. A consideration of age is of prime importance in the work of a dentist, be it preventive, corrective, operative, or restorative.

I wish to acknowledge the courtesies, advice, and privileges extended to me by the late G. Carl Huber, director of the Anatomical Laboratories, and Carl E. Guthe, director of the Museum of Anthropology of the University of Michigan.

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THE VALUE OF ORTHODONTIC APPLIANCES MADE OF CORROSION-RESISTING STEEL (18-8) IN PRACTICE

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THE term "corrosion-resisting steel" as used in this article applies to high chromium, high nickel steel used in the construction of orthodontic appliances. This steel was reported in the journal *Stahl und Eisen* in 1914 by Benno Strauss and Eduard Maurer and was first shown as a commercial product at the Malmö Exhibition in April of that year. At present it is used widely in the industrial field, and as it is based on a standard of 18 per cent chromium, 8 per cent nickel, it is known as an austenitic alloy and recognized by the term 18-8.

The following brands may be classed as typical:

MANUFACTURER	BRAND
Krupp	V2A
Thomas Firth and Son, Ltd.	Staybrite
Brown Bayley's Steel Works, Ltd.	Anka
Rocky Mountain Metal Products Co.	U.S.S. stabilized 18-8
Avesta	832M
Nippon Kinzoku Kogyo K.K.	N. T. K. 8
Yawata Seitetsujo	NC. 6
Nippon Tokushuko G.K.	ST. 5

For a number of years after its discovery, use of the new steel was limited to the chemical and food industries, architecture, and the construction of aircraft, submarines, and other conveyances; but in 1920, as a result of Dr. F. Hauptmeyer's investigations, it was introduced as a material for dental prosthesis; and through the research work of P. Simon, R. Schwarz, G. Korkhaus, S. Friel, De Coster, A. Brusse, and J. Wunderly, its value as an orthodontic material was confirmed.

At present, in America and Europe different kinds of 18-8 are being used as material for orthodontic appliances, and the rapid transition from the gold alloy era to that of noncorrosive steel is especially distinct in orthodontia.

GENERAL PROPERTIES OF 18-8

This alloy is more ductile than any carbon steel and can withstand much greater deformation without rupture in forming and drawing. It cannot be hardened by heat treatment, but only by cold work, in which case it can be hardened rapidly and its elongation is lessened, as shown in Fig. 1.

This hardening, which is quicker than in any other steel, is more conspicuous when the carbon content is high, so an increase in the nickel content naturally decreases the rate of hardening.

A higher tensile strength of 200 kg. per sq. mm. can be obtained by cold work on thin gauged wire.

After it has been annealed at high temperature (1150° C.) and rapidly cooled, the metal consists of a single phase, austenite, and possesses the maximum

From the Orthodontic Department of the Dental Academy of Tokyo.

softness and corrosion resistance. This condition differs slightly according to the composition, heat treatment, and shape of the specimen, but it may be approximately defined as follows:

Ultimate strength	56- 70 kg. per sq. mm.
Proportional limit	13- 21 kg. per sq. mm.
Elongation (50 mm.)	60- 50 %
Reduction of area	65- 50 %
Brinell hardness	140-170

The steel has low electric and heat conductivity, which may be fixed as about one-fourth that of ordinary mild steel. As shown in Figs. 2, 3, and 4, when cold worked 18-8 is reheated to various temperatures up to 1000° C., the tensile strength falls with fair uniformity between 600° and 1000° C., but the proof load and Brinell hardness curves show the characteristic break at 800° C.

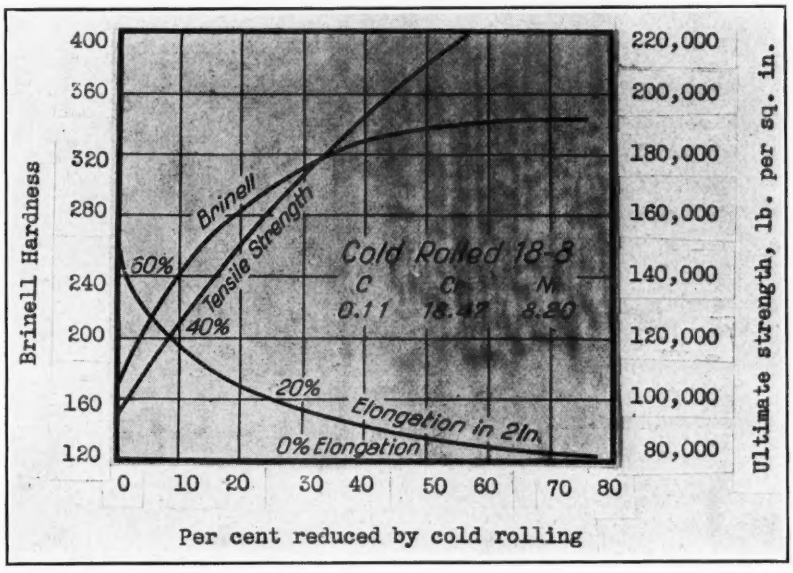

Fig. 1.—Influence of cold rolling on strength, ductility, and hardness of 18-8 (by Scharschu).

The corrosion resistance is decidedly stronger than that of ordinary stainless chromium steel, but according to C. H. Scharschu, 18-8 which is cold worked has a lower noncorrosion property than that which has been annealed. When held for any length of time between the range 600° and 700° C., 18-8 undergoes a definite loss of its noncorrosive nature. This tendency is greater when the carbon content is higher, which may be attributed to the following. When 18-8 containing more than 0.02 per cent carbon is so heated, it becomes susceptible to intercrystalline corrosion, which is a precipitation of chromium carbide along the grain boundaries, resulting in a loss of chromium in the solid solution and consequently a loss of resistance to corrosion. To prevent this phenomenon, E. C. Bain, R. H. Aborn and J. J. B. Rutherford have pointed out the advantage of using suitable amounts of titanium, columbium and molybdenum, which combine with the carbon more easily than does the chromium, and adding them to low carbon stainless steel. Galvanic action may also attack 18-8, and it is

therefore advisable to keep it from contact with any other kind of metal or alloy. Nevertheless, when the steel is actually used in the mouth in orthodontic

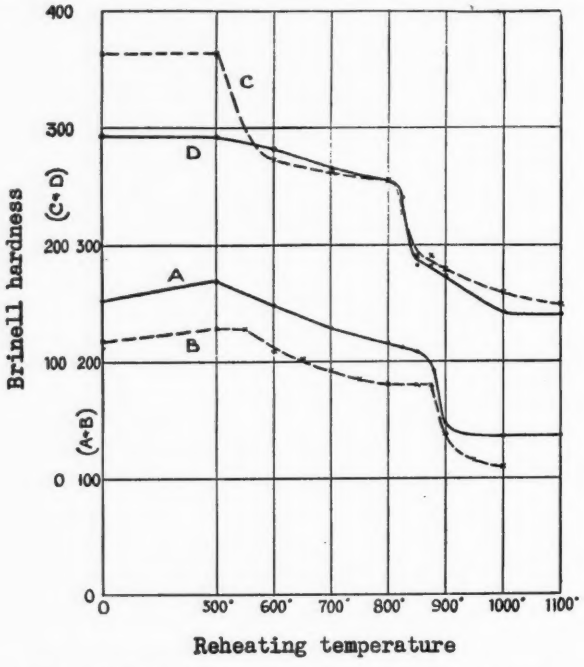

Fig. 2.—Effect of reheating to the temperatures indicated on hardness of cold worked steels (by Monypenny).

Curve	Carbon %	Chromium %	Nickel %
A	0.13	11.2	11.9
B	0.08	11.5	15.8
C	0.12	18.0	8.2
D	0.16	16.0	11.2

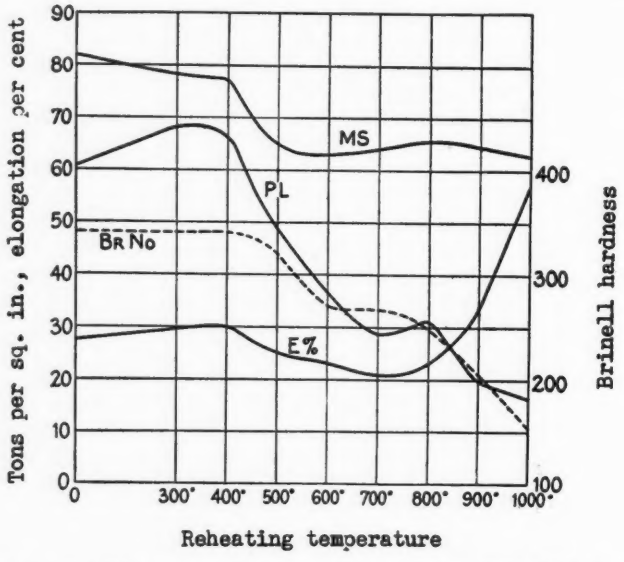

Fig. 3.—Effect of reheating on tensile properties of cold rolled strip (by Monypenny).

Carbon %	Chromium %	Nickel %
0.10	17.1	8.1

cases, the foregoing type of corrosion seldom occurs and therefore need not cause any anxiety.

The use of spot welding and shot welding brought 18-8 into a wider range of service, such as the construction of aircraft, railway coaches, motor cars, and ships.

In spot welding the following three properties of the metal are favorable: a comparatively low melting point(approximately 1370° C.), high electric re-

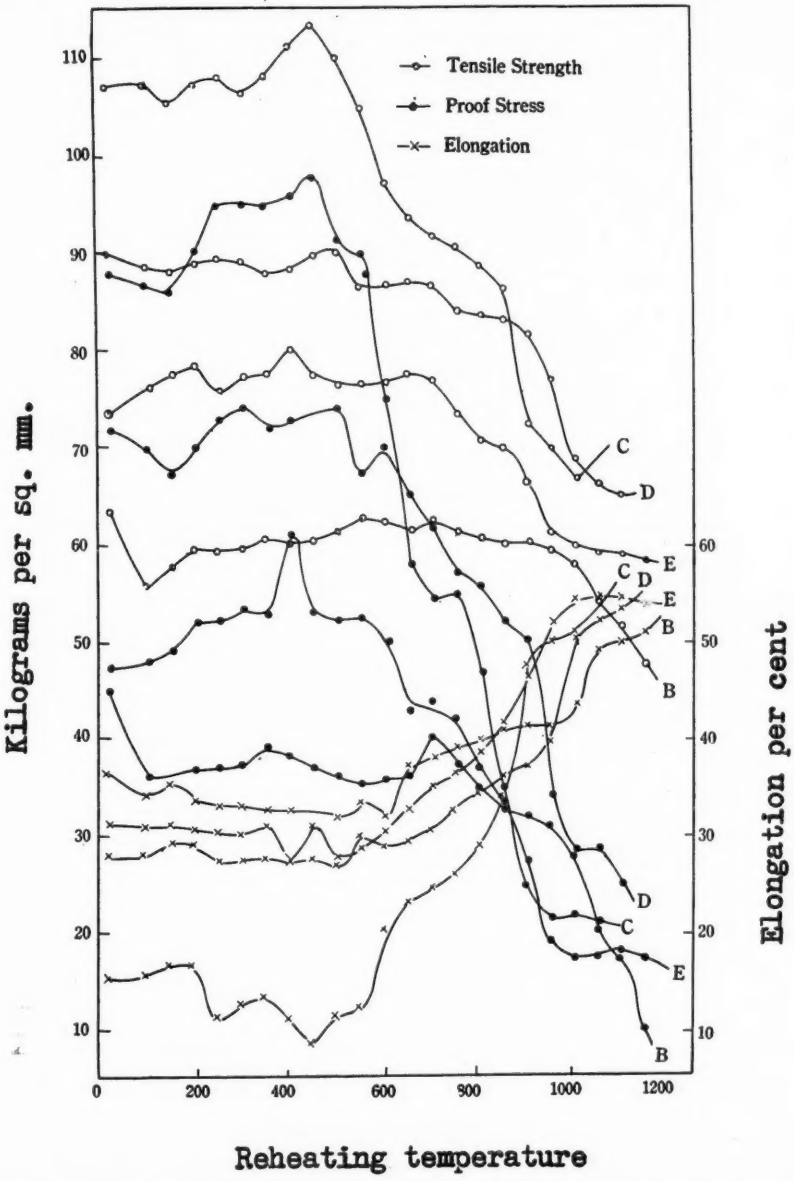

Fig. 4.—Change in mechanical properties of 18-8 due to annealing temperatures (by M. Kinugawa).

Curve	Carbon %	Chromium %	Nickel %
B	0.2	18.6	7.98
C	0.15	19.39	7.59
D	0.10	18.40	8.40
E	0.05	15.49	9.40

sistance, and low conductivity of heat. The welding is done mechanically by gripping the seam between two snub-nosed welding dies (electrodes) made of hardened copper, and passing a low voltage high amperage current.

In any welding operation it is important to minimize the area heated and to shorten the time of passing the current through the metal. Since the complete separation or formation of the carbide phase does not occur instantaneously, the maximum effect is obtained only with prolonged heating. The heat developed is proportional to I^2RT, where I is the current, R the total surface resistance and internal resistance between electrodes, and T is the time of application. The volume of metal to be heated is definite for a given thickness of metal, and the current and time must be controlled accurately.

It is easy to weld two sheets of metal of the same thickness, but the welding of sheets of markedly different thickness, or wire to wire or a tube to a sheet, is extremely difficult and therefore should be avoided. In such cases some orthodontists recommend the use of a special form of electrodes, but whether the results are truly favorable is somewhat doubtful.

At present I am using the welding method for bands and the various tubes attached to them, but for arch wires and springs, etc., I obtain the best results by soldering. When connecting tubes by welding, it is necessary that they have a flange, for the band and the flange are welded together. When the band and

Fig. 5.—Showing the most advantageous form of electrodes in spot welding.

the flange together measure less than 0.15 mm. in thickness, the electrodes need have only a simple tip with a surface 1 mm. in diameter, as shown in Fig. 5, and various forms of electrodes need not be used.

USE OF 18-8 IN ORTHODONTIA

For the past three years I have been using orthodontic appliances made of 18-8 in more than a hundred cases and have obtained very promising results. Experience has proved the 18-8 of the Nippon Kinzoku Kogyo K.K. just as good as that of the European and the American companies, and I am a firm believer in its excellence.

The following is a specification of the materials and their characteristics.

COMPOSITION

Carbon	0.08% max.
Chromium	18.00%
Nickel	8.00%
Titanium	0.3%

DIMENSIONS OF THE BAND MATERIAL
(Annealed 18-8 strips)

GRADE	THICKNESS IN MM.	WIDTH IN MM.
No. 1	0.07	4.0
No. 2	0.13	4.5

After the material has been heated to 900° to 1000° C., it must be cooled immediately and only one side polished to a mirrorlike luster.

Band material of a soft nature is most suitable, and it is very important to leave one side of the strip unpolished; otherwise it is difficult to insure stability after it is cemented.

When 18-8 wire is used, the rate of the cold work must be carefully determined; for, when it is moderately drawn, it is generally suitable, but I do not think it worth while to use wire in a soft or a fully hard condition. From experience, I deem it possible to recommend the following conditions.

HARD DRAWN 18-8 WIRE

(In Bright Condition for Drawing in Diamond Dies)

GRADE	DIAMETER (MM.)	ULTIMATE STRENGTH (KG/MM.^{2})
No. 1	0.91	145-150
No. 2	0.70	155-160
No. 3	0.57	160-170
No. 4	0.40	180

Bend test: At room temperature when bent 180 degrees it must not split on the outer side of the bend.

FLANGED TUBES

The flanged tubes heretofore used have been formed by pressing and therefore are not durable, as the shafts and tubes lack conformity. By the use of flanged seamless tubes not only can accurate conformity be obtained, but, as the thickness of the flange corresponds generally to that of the band, they can be welded without difficulty. The time and trouble of polishing can also be eliminated.

TECHNICAL CONSTRUCTION OF ORTHODONTIC APPLIANCES

To make an incisor or a molar band, it is necessary to have them overlap less than 1 mm. and then to weld them together. In spot welding, the "dwell" of the current is of the utmost importance, and correct technic to insure uniform welds involves careful control of a dozen variables, such as clean surfaces, good contacts, electrode pressure, and voltage line drop. In a good weld the fusion should extend well into each sheet and yet not break the outer surfaces. The Budd Co. specifies that the overall depth of fusion should not be less than 50 per cent of the combined thickness of the two sheets, nor more than 80 per cent. A good way to test welds is to twist them apart. If the weld fails by rotational shear at an angle less than 70° the fusion has been too shallow.

When joining a buccal tube (horizontal tube) to a molar band, it often happens that it must be connected to the gingival margin of the band.

In such cases, the longer flange is bent straight up, as shown in Fig. 7, so as to enfold the band, and thus the three pieces are welded together at the same time. Nevertheless, when welding it to the middle of a band it is treated as in the case of a lingual tube, and the flange need not be folded back.

For a lingual lock the Ellis type of loop lock is the best when 18-8 is employed. When used for the shaft of a loop lock, the arch wire is bent to form a loop, and the most accurate results can be obtained by using the specially devised pliers shown in Figs. 8 and 9.

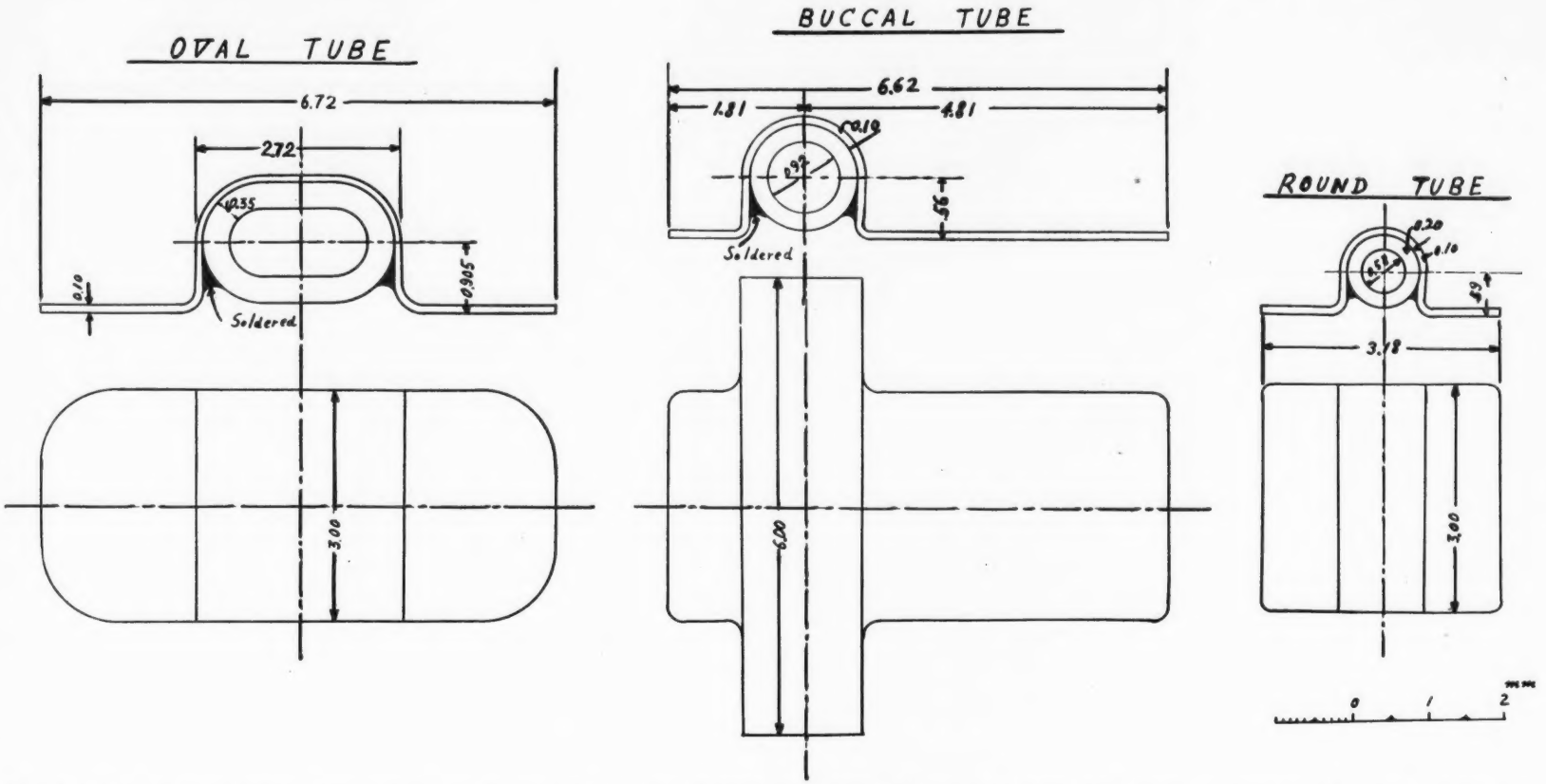

Fig. 6.—Besides these tubes there are others in use such as the flanged oval tube and the open tube, both made to conform to a wire of 0.7 mm. diameter, and the flanged round tube having on inside diameter of 0.4 mm.

Instructions.—Take the part of the arch wire most suitable for the shaft and bend it at right angles; hold it at the bend with the pliers according to Fig. 9, *I*. Take the arch wire and bend it around the tip of the pliers (*b*) as in *II*. Take the loop in between the pliers and press tightly together, so that no space is left between the loops, as in *III*. Then, keeping the loop in the same condition,

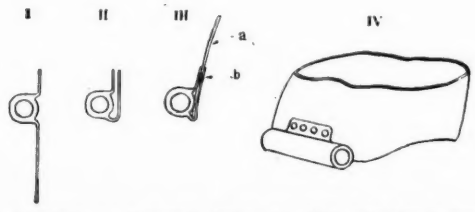

Fig. 7.—The method of joining a flanged tube to the gingival margin of a molar band: *a*, molar band; *b*, spot weld.

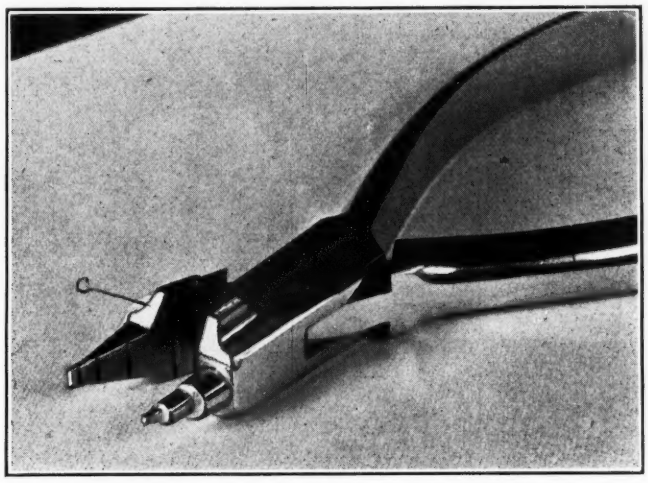

Fig. 8.—Special pliers with gripper, *C*, for making an Ellis lock.

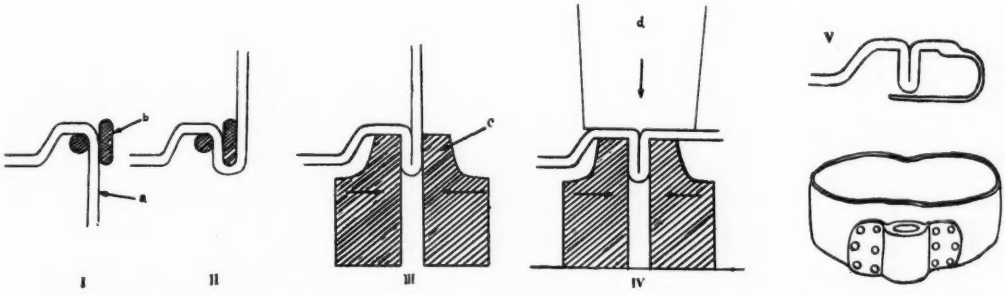

Fig. 9.—Showing the process of making an Ellis lock by means of specially devised pliers: (*a*), lingual arch wire; (*b*), the tip of the pliers; (*c*), pliers, showing gripper; (*d*), hammer.

strike with a hammer (*IV*), making a distinct and clean angle where the arch wire forms the shaft. Thus it is possible to make the shaft conform accurately with the tube, and to attain definite length of shaft.

The lock wire is attached to the end of the arch wire by means of gold solder as in *V*.

When attaching an auxiliary spring to arch wire, it is not advisable to use the welding process, which is applied in the case of a band. Even though it be possible to weld, the joint would be unable to stand any stress and would be useless as a spring, for not only would it lack strength of joint but the arch wire would be liable to distortion during the welding process.

Spot welding is used when uniting a band with a band or a band with a flange; otherwise soldering is considered more advisable.

When soldering an auxiliary spring to arch wire, the solder must be a gold one with a melting point below 800° C. The spring and the arch wire must be cleaned mechanically with a scraper before the soldering operation is performed, and the parts to be joined must fit tightly, after which a sufficient amount of flux, in the form of a thick paste, is applied. A proper flux containing potassium fluoride is certain to work well.

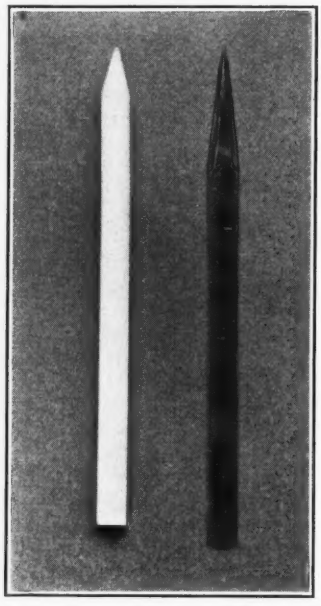

Fig. 10.—Instruments used for polishing soldered wires: right, scraper; left, pumice stick.

The soldering operation must be performed as speedily as possible by feeding the solder wire rapidly into the beads as soon as the flux forms into beads. After this is done, remove the flux remaining on the wire with a scraper, and then polish the wire with a slightly moistened pumice stick (Fig. 10). Buffing and pickling are never to be performed.

The auxiliary spring is soldered obliquely to the arch wire, after which it is partially twisted (according to Mershon's method). Thus the mechanical properties of the spring wire near the joint, which have been lost owing to the heat, will be restored to some extent.

Nevertheless, if the spring wire is heated to more than 800° C., the steel will suddenly lose its mechanical properties as shown in Figs. 2, 3 and 4, and no amount of twisting will suffice to harden it. Consequently it will be useless in fulfilling its purpose.

When soldering, therefore, much care must be taken to avoid failure from overheating.

SUMMARY

1. Hard drawn 18-8 wire, when heated above 800° C., suddenly loses its mechanical properties. As it is impossible to harden it by heat treatment, it is necessary to perform the soldering operation at a temperature below 800° C. In such cases, it is possible to restore its mechanical properties in a large measure by twisting the wire near the joint, as 18-8 possesses the property of rapidly hardening when cold worked (Fig. 1).

2. Spot welding is suitable only when the thickness of the band or flange more or less corresponds to that of the sheet to which it is to be welded, and should not be used to join auxiliary springs and arch wires.

3. One kind of electrode is ample for spot welding in the construction of orthodontic appliances.

4. Hard drawn wire should be moderately hard, although this differs according to the diameter of the wire.

5. Seamless flanged tubes are more useful and give better results than tubes made by pressing.

6. The Ellis type loop lock must be hammered to make an accurate and cleanly shaped shaft.

7. When making orthodontic appliances of 18-8, buffing and pickling are unnecessary, if not inexpedient. The scraper and the pumice stick are sufficient when polishing.

8. When using an appliance made of 18-8, it is necessary fully to understand its properties and to employ the most suitable heat treatment.

I wish to acknowledge my gratitude to Messrs. Y. Kunioka of the Nippon Kinzoku Kogyo K.K., H. Okuda of the Japan Nickel Information Bureau, J. Suzuki of the Seidensha Electric Works, and Prof. S. Takahashi, who have been willing and helpful advisers in my researches.

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DENTAL NEEDS OF CHILDREN AND OUR PROFESSION

R. M. Erwin, Jr., D.M.D., Portland, Oregon

THE endurance and the merit of any profession are dependent upon its ability to better itself progressively. If at any time improvement of its fields of understanding ceases, its subsequent degeneration in ability adequately to serve man is certain. Furthermore, as individual dentists, the same fate awaits those of us who become mentally stagnant and do not keep abreast of the current improvements that the profession offers.

The profession of dentistry has in the past decade given many commendable and valuable services and additional knowledge to the individual dentist and to the public at large that comes to his office. Embarrassing as it may be, we must admit that some of the older principles to which we have adhered are contradictory to the newer and more logical ideals recognized as correct today. It naturally follows that we must accept the new that may be logical and abandon the obsolete. It is truly said that "A wise man will change his mind; a fool, never." Consequently, having corrected the false impressions in our own field of understanding, we are obligated to our patients to reeducate them and rectify the erroneous ideas that we have in the past presented to them.

This need of correcting certain ideas that have been imparted to the prospective patient is justly applicable to many phases of the profession, but it is especially true of those considerations dealing with the dental needs of children. Until relatively a recent date, the general attitude of the dentist toward a deciduous tooth that was seriously involved may be summed up in that time-worn expression, "Extract it, it's only a baby tooth and will come out after a while anyhow; so why bother with it now?" We may excuse such an attitude of the past due to a lack of understanding by the profession at that time, concerning the importance of the first dentition and its close relationship to the permanent set of teeth. At the present time, however, for any disciple of modern dentistry to make such a statement is without excuse; for now the profession realizes the detailed function and importance of the deciduous set of teeth and the need of retaining them until the normal time of exfoliation. For a dentist to take such an attitude and impress his parent patient with such an opinion is to indict himself immediately by his own words; for it indicates without reservation either a complacent indifference to the advancements and newly accepted theories of his profession, or a criminal negligence of the welfare of his young patients merely because he is aware of his inability to cope with the situation, and is ashamed to admit his weakness.

Fortunately this type of man is not representative of the average in our profession, although it would appear that there are far too many even so; for we still hear the condemning statement relative to the futility of attempting to do anything for deciduous teeth. Such a statement comes to us from the parents when the subject is discussed, and it is up to us as dentists of today to dispel this indifference.

The average individual is blessed with a reasonable degree of patience and is thereby equipped to deal with the average child, needing only to add a willingness to try to reach the understanding of the junior patient.

We hold that our line of endeavor is not of average accomplishments, but rather it is a profession. Admitted that this is true, yet basically it is a business and we are not permitted "too much altruism" because of this fundamental. Consequently we can employ many of the means of attracting people to our services by using discreetly some of the same appeal that our more commercial types of endeavor employ. That to which I refer is the appeal to the adult mind through the interests in the welfare of the child. Psychologists have observed that love for the offspring and their welfare is second only to the urge for food. Other lines of endeavor have capitalized upon that phase alone. As an example, we may note the business appeal of a nationally known automobile company. In the attempt to sell safety glass they picture the back seat of the auto surrounded by windows, and in the back seat they picture not the father, the mother, the family dog, or any one else except the child; and then they appeal to the buyer to protect the child's safety—thereby selling the commodity. Another example is the sale of certain brands of soap flakes upon the boxes of which are printed cut-out circus pictures, Mickey Mouse, etc.; the manufacturer knows full well that it offers a means to the mother to keep the child busy while she is doing her work, and that the child will undoubtedly ask the mother to buy the soap flakes with the pictures on the box. Furnace manufacturers picture a child at the control lever of the furnace to show that "even a child can operate the heating unit," and again the attraction is made through the immature.

Any number of similar examples could be enumerated to illustrate the point, and we as dentists have the same opportunity. I do not mean to infer that brazen advertising should be employed, but I do refer to our becoming child-dentistry minded. By adopting that principle we shall be rendering a real health service to the public now, and the rewards may be reaped in the years to come by a race with better dental conditions. The appeal should be made by talking dental needs and health *for children,* and being thoroughly convinced of its benefits ourselves. The parents are naturally eager to learn of anything that they can do to make the welfare of their children more assured, and if by our sincerity we can provide them with such information and convince them that our knowledge of the dental needs for children is sound, that we are eager to prevent serious complications in later years by working for the child now, we shall have gained their esteem and their confidence that we are competent and conscientious. Such a relation between our patients and ourselves will naturally bring the parents to our offices for their own dental needs.

The same appeal is true in another light: if an obstreperous child is brought into your office and by patience you can win him over and accomplish what seemed impossible to the adults, they will return to their own neighborhood and tell how well you and their little "Johnny" got along. Mrs. Brown across the street will hear of it and think that, if you have the patience to deal with that little "imp" and not inflict too much pain, you would be a good dentist for her to go to with her "jumpy nerves."

It would naturally follow that, if for no other reason than the monetary consideration, *it pays to do children's dentistry.* Furthermore, the benefits derived by dispelling "but it's only a baby tooth—" will far exceed any other return to ourselves or to the people who depend upon us for dental ideals.

CASE REPORTS*

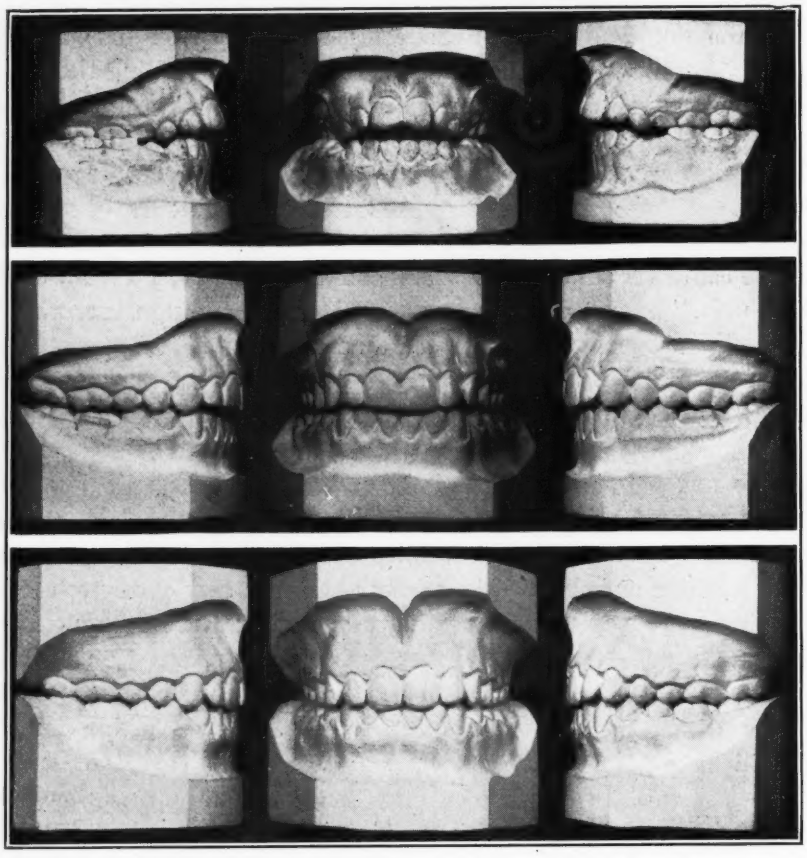
EVERETT A. TISDALE, D.M.D., BOSTON, MASS.

THE first case is one that was used to illustrate an article submitted to the American Board of Orthodontia and published in the INTERNATIONAL JOURNAL OF ORTHODONTIA, November, 1935. The method of treatment was such that it was suggested that a full report of the case might be of sufficient interest to present at this time.

Fig. 1.

Fig. 2.

Fig. 3.



Figs. 1-3.—Case 1. *1*, March, 1929. *2*, June, 1932. *3*, April, 1934.

The patient was a girl, ten years of age, who presented for treatment in March, 1929. The malocclusion was diagnosed as Class I, with underdevelopment of the maxilla and an open-bite associated with a tongue habit. The patient had a slight peculiarity of speech—almost a lisp. There was no pertinent past history. No other member of the immediate family had a similar malocclusion.

Treatment was begun in the routine manner, a labial expansion arch being placed on the maxillary arch for general development, and maxillary central

*Read before the New York Society of Orthodontists, New York, N. Y., March 24, 1936.

incisor bands were placed with labial platinum loops for the reception of the arch wire. Six months later a lingual appliance was placed on the mandibular arch for slight development and alignment of the anterior teeth.

Treatment was carried on, and the general development and alignment were obtained by August of the following year, when maxillary and mandibular lateral-to-lateral retainers were placed. At this time the anterior open-bite had been reduced nearly to an edge-to-edge bite, and it was thought that through function this would further correct itself during the period of transition.

With the eruption of the permanent teeth, however, it was necessary to obtain slight additional expansion and to rotate the maxillary permanent canines. This was done and a maxillary vault retainer was placed with bands on the second premolars. A maxillary canine-to-canine retainer was placed to maintain the rotation. This was in February, 1933, four years after the original treatment was begun.

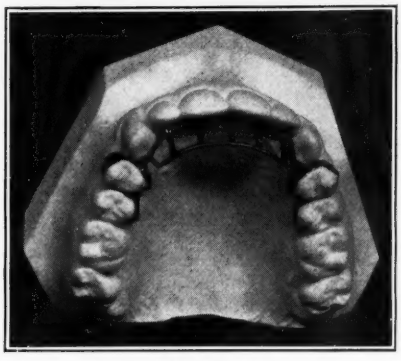


Fig. 4.

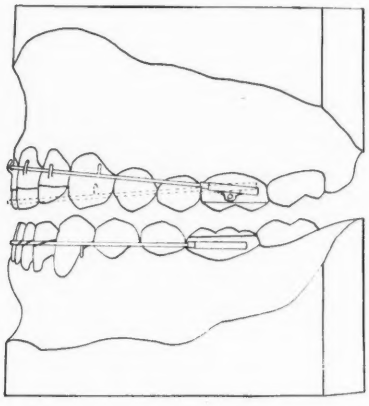


Fig. 5.

Fig. 4.—Tongue guard (Case 1).
Fig. 5.—Swivel-tube appliance (Case 1).

The open-bite condition, however, had not been fully corrected; and it seemed to get worse rather than better, with the tongue continually forcing its way between the teeth, preventing the establishment of a normal overbite. It was decided to take definite means to correct this condition, and in November, 1933, appliances were replaced. The maxillary incisors were in infraclusion; so a labial arch wire was placed on the maxillary teeth with swivel tubes on the molars, allowing the arch wire to swing freely in an incisogingival direction. Bands were fitted to the maxillary incisors with labial locks to receive the arch wire. A labial arch wire was placed on the mandibular teeth with soldered buccal tubes on the molars. The arch wire was ligated to the mandibular incisors with steel ligatures and cement beads on the lingual surfaces of the teeth. Small elastics were worn from the maxillary wire to the mandibular wire, in the canine region. In this manner reinforced stationary anchorage was obtained in the mandibular arch against mass simple resistance in the maxillary arch.

The principle of the swivel tube is not new in orthodontics. It was utilized by Dr. Lawrence Baker many years ago to obtain simple anchorage in moving molar teeth distally. Recently I have used it as outlined in this case for reducing open-bite conditions with gratifying results.

In six months' time a definite overbite had been established, and it was necessary to make certain that the tongue habit had been cured. Previously a tongue guard attached to the mandibular lingual appliance had been used —similar to that shown by Dr. Jackson several years ago. This had not been satisfactory, in all probability because sufficient overbite had not been established. At Dr. Bonin's suggestion a guard was now made attached to bands on the maxillary first premolars, the principle of the guard being that a definite interference with an established habit is the surest way to correct it and to establish a new one. This guard was worn for nine months when all appliances were removed and a cast metal stay-plate with half clasps on the canines was made to retain the width of the maxillary arch. The wearing of this was gradually discontinued.

If I had to treat this case over again, I should utilize the swivel tubes to establish a definite overbite earlier in the course of treatment and with the aid of the tongue guard materially reduce, I believe, the period of treatment.

The second case is of interest mainly because of the questions it raises with regard to the relation of root formation to the eruption of the teeth.

The patient in this case was a girl seventeen years of age who presented with both mandibular deciduous second molars firmly in place. Radiographs showed both permanent second premolars present. The right one was horizontally impacted with the crown practically against the mesial root of the permanent first molar near the apex and slightly lingual. A slight bulge could be felt low down on the lingual plate of the alveolus in this area. The left premolar was impacted at an angle of about 45 degrees toward the permanent first molar but apparently not in contact with it. The roots of the deciduous molars were only slightly resorbed. The roots of the impacted teeth were only partially developed.

These conditions were attributed to a lack of the normal resorption of the deciduous roots and retention of the deciduous molars far beyond the time for their normal exfoliation.

All the permanent teeth, with the exception of the third molars, were in place. The occlusion was almost normal and the function good.

The deciduous molars were extracted, and a lingual appliance was placed on the mandibular teeth with auxiliary spurs to prevent drifting and to hold the space for the premolars. This was done in December, 1929. No further treatment was attempted at that time. Radiographs were taken at intervals to watch any possible movement of the impacted teeth. By March, 1930, three months later, the left premolar showed definite evidence that it was tipping up and moving toward eventual eruption. The right premolar, however, remained in its previous position, and the patient reported occasional tenderness of the permanent molar. It was thought that further waiting might lead to injury to the first molar root; so in June, 1930, a portion of the lingual alveolar plate was removed to expose part of the crown of the

premolar. With some difficulty an impression was taken of the exposed surface, not more than 3 mm. square, and a cap swaged and cemented in place. A small loop of wire had been soldered to this cap, and this was attached by means of a silk ligature to an auxiliary spring on the lingual arch wire.

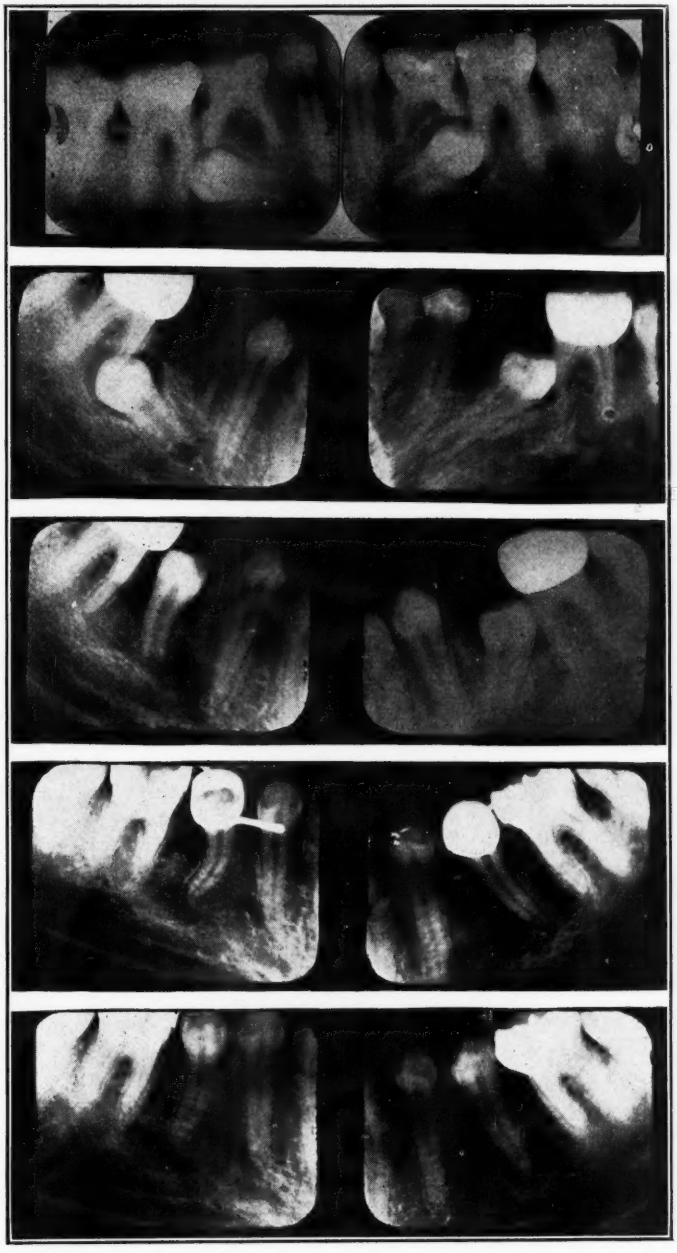


Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Figs. 6-10.—Case 2. *6*, December, 1929. *7*, March, 1930. *8*, February, 1931. *9*, May, 1932. *10*, March, 1936.

The tooth was gradually teased up to the line of occlusion by February, 1931. In the meantime the left premolar had erupted. Bands were then placed on both premolars further to assist them into occlusion. Radiographs showed that the premolar roots, that had been little more than half formed

when treatment was commenced, had developed much further and were formed in a curve along the line taken in eruption.

The teeth, although occupying their proper position in the arch by May, 1931, were in complete torsoversion, the buccal cusps being lingual. At that time all appliances were removed for the summer. In November they were replaced, and bands were again placed on the second premolars to afford attachment for turning them into their proper positions. This was accomplished in about six months' time. Bands with spurs were then placed to maintain the rotation, and the lingual arch wire was removed. Radiographs were taken which showed that the roots, which had formerly curved toward the mesial, now curved toward the distal. There had been no marked tenderness of these teeth during this extreme movement, and they have since, to all indications, maintained complete vitality. The retaining bands were removed in the fall of 1933.

Close examination shows that the root of the right premolar completed its development after the rotation had been accomplished. X-ray pictures taken within the last two weeks show the roots fully formed, the canals reduced in size, and conditions normal in every respect.

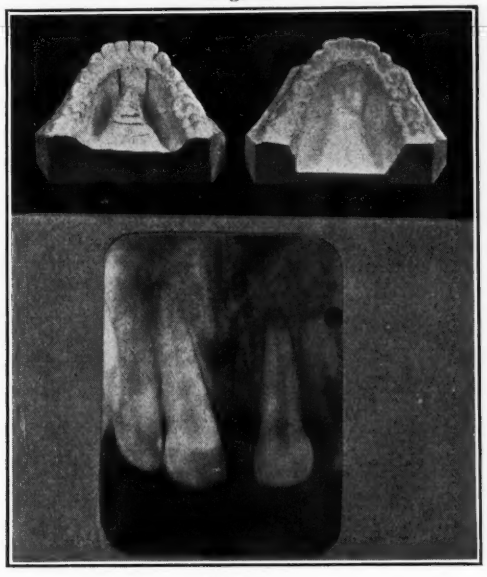
REPORT OF CLASS II CASE WITH SEVERE COMPLICATIONS

CHARLES A. SPAHN, D.D.S., NEWARK, N. J.

A REPORT of an orthodontic case, I believe, should begin with the history and clinical examination of the parents of the individual, when possible, in order to obtain a cross-section of any interesting or unusual conditions to be reported about the case in hand. There is nothing in the history of the parents that could be considered pertinent to this report of their son.

The patient presented for treatment in April, 1934. At that time the boy was twelve years of age, and all the permanent teeth had erupted with the second molars just coming into position. The following diagnosis was made: distoclusion with the corresponding protrusion of the maxilla and retrusion of the mandible; with buccal occlusion of maxillary left and right first bicuspids, there was a very deep overbite, the maxillary incisors completely covering the mandibular incisors, and quite a separation between the maxillary central incisors. The mandibular incisors were biting up into the soft tissue just back of the maxillary incisors. The lingual frenum was unusually strong and heavy, with a fanlike attachment high up between the mandibular central incisors. The radiographic examination showed nothing of unusual interest, unless it might be that the median suture was especially pronounced and extensive. The maxillary third molars are present, but in the mandible these teeth are missing. (Figs. 1-5.)

Fig. 2.



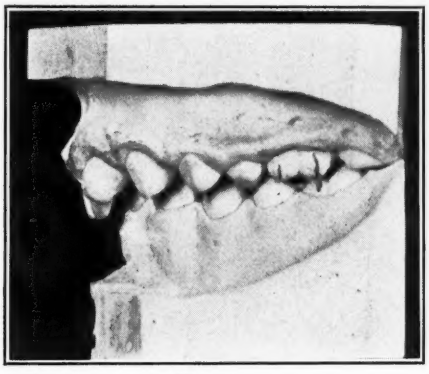


Fig. 1.

Fig. 3.

Fig. 1.—Original model.
Fig. 2.—Models showing frenum.

Read before the New York Society of Orthodontists, New York, N. Y., March 24, 1936.

Etiology.—I believe the origin of the trouble was partially congenital; although so far as I have been able to determine from the mother's history, the birth was perfectly normal, no forceps were used—the child was breast fed until about seven or eight months old. There were no bad posture habits which might be considered as a contributing cause. The parents claim the child had a beautiful set of deciduous teeth, although we have no evidence that they were not badly positioned.

Fig. 4.

Fig. 5.

As for the boy's physical condition, the following is his history as given to me by the parents. This report covers the period up to the time he presented himself to me for treatment.

"When my son came to you, his physical condition in certain respects was not satisfactory. His nose had a constant discharge of mucus, and with the slightest symptoms of a cold this became thick and heavy, causing great discomfort and annoyance to himself and others.

"He had previously been under the care of a nose and throat specialist, who for one winter gave him at least two treatments each week and the following year gave him treatments once a week and oftener when he felt it neces-

sary. While this helped him somewhat at the time, no definite cure was effected, and the condition remained, causing him to blow and sniff almost incessantly.

"I frankly doubted, therefore, that anything could be done to cure the boy, but was only too willing to try again for his sake."

This description of the condition does not fully portray, by any means, the severity of the catarrhal nasal irritation with which this boy suffered. For instance, he used at least four or five handkerchiefs a day, completely saturated with mucus, and his handkerchief was constantly in his hands. He was continuously blowing his nose with a rasping and vicious force to clear the passage. This constant mechanical strain I believe to be partially the cause of the unusual maxillary and nasal protrusion or deformity. This nasal condition, according to the history, began probably not later than when he was five years of age and, thus, had been present for about six years.

To continue the history according to the mother:

"Consequently, when you suggested a definite program for my son, both he and I agreed to whole-hearted cooperation. This program consists briefly of three simple things done after rising in the morning. First, two full glasses of water. Second, setting-up exercises done rigorously and including a shoulder stand for ten seconds. Third, a cold shower followed by a brisk rubdown. You also suggested sniffing a normal salt solution.

"He has followed this procedure conscientiously for practically a year and a half. This winter he has remained entirely free from colds in spite of being exposed at school and by two younger children in the family. He has missed exactly two days from school since the September opening; whereas last year he was absent twenty-four and one-half days, the greater part of which was due to colds. His whole general physical condition has improved, resulting in a splendid appetite and far better nervous control."

The above instructions in daily application of morning hygiene seemed to be the only way to bring about a tolerant condition in order to go on with orthodontic work.

At this point I wish to emphasize the highly nervous state of mind which was continuously present in the patient while he was in the chair and due primarily, I believe, to his inability to blow his nose while having any operating done in his mouth. He could hardly remain ordinarily quiet for more than thirty seconds without handling his nose, shuffling his feet, and showing other signs of unrest.

About six months after the beginning of treatment the patient was referred to Dr. Cardwell, a nose and throat specialist, for examination and treatment. I give you the diagnosis and treatment according to Dr. Cardwell.

"The patient was first examined in November, 1934, at which time he was diagnosed as having a purulent rhinitis bordering on an atrophic. The sinuses transilluminated slightly darker than normal. The left antrum was washed and

strings of mucus were found in the washing. The right antrum washed clear. Packing under the middle turbinate with neosilvol, 10 per cent. Was treated ten times, and given considerable relief."

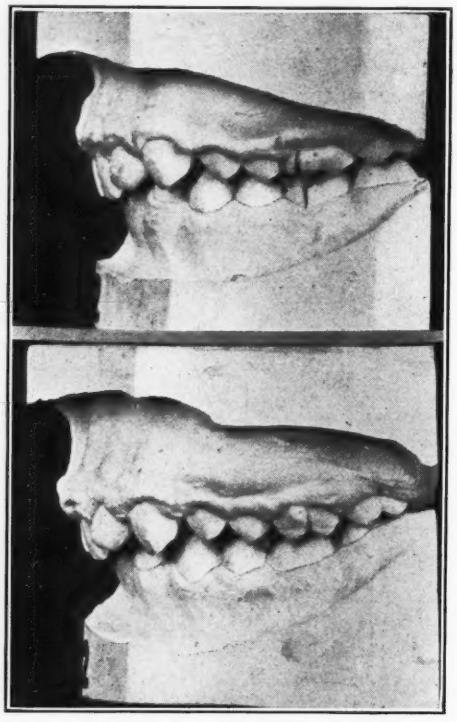
"On December 9, 1935, the lingual frenum was divided and sutured, releasing the tongue."

So much for the general outline of the condition of the respiratory apparatus.

The appliances used were as follows: the usual maxillary labial arch, round buccal tubes on molars, hooks in the canine area; mandibular lingual arch with recurved auxiliary springs, hooks on the buccal side of the mandibular first

Fig. 6.

Fig. 7.



molar. Number seven elastics were worn from May to December, 1934, which resulted in the condition as shown in Fig. 6.

All during the application of these appliances the upper facial gum tissue took on an acute hypertrophied growth; and, regardless of the application of the toothbrush and massaging of soft tissue, it could not be controlled. He was retained in this condition from December, 1934, to October, 1935. During that time many different treatments were considered in order to reduce the tremendous overbite and separation between the central incisors, but at no time could I arrive at a satisfactory diagnosis. In October, 1935, I did, however, apply six anterior bands and a ribbon arch, in an attempt to change the angle of inclination of these six anterior incisors and retrude them at the same time, or, in other words, create a definite change in the inclination of these six anterior incisors. After two weeks from the date of its insertion, without pressure, the tissues of

these anterior teeth took on a considerable degree of growth and swelling, so much so, that I hesitated to adjust the arch to move these teeth in the direction in which it was planned.

I kept him under observation weekly, and in the course of four weeks I adjusted the maxillary arch to bring about this movement of the teeth. After three weeks of this action it was decided that I would have to stop treatment because the clinical symptoms were so severely pathologic.

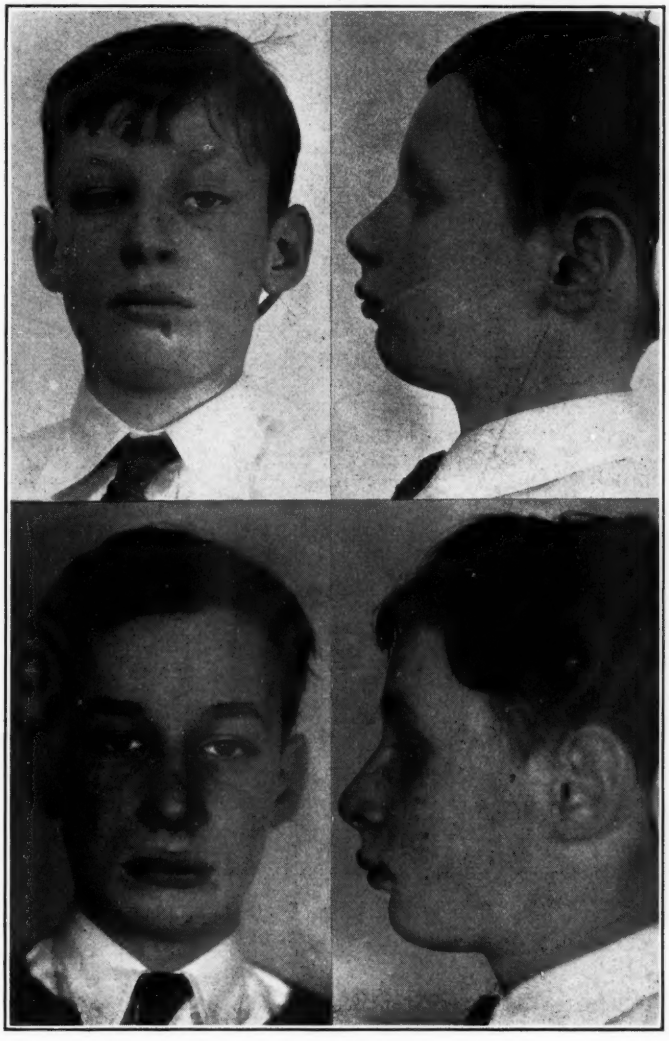


Fig. 8.

The appliance was therefore removed, and after two weeks an impression was taken (Fig. 7). This is the condition of his teeth at the present time.

I believe the mesial distal relationship to be more or less favorable. If he continues the daily routine of his body hygiene, the inflammatory process which has been present in the entire breathing and masticating apparatus will continue to improve.

As it is expressed by his mother: "When I consider the excellent results obtained by my son's following your simple program, I feel absolutely confident

that a definite cure of his nasal condition is now within easy sight and correspondingly grateful to you for having made this possible."

The position of the anterior teeth, I feel, is still very unfavorable and will probably grow farther from the normal because of lack of mandibular third molars.

Fig. 9.

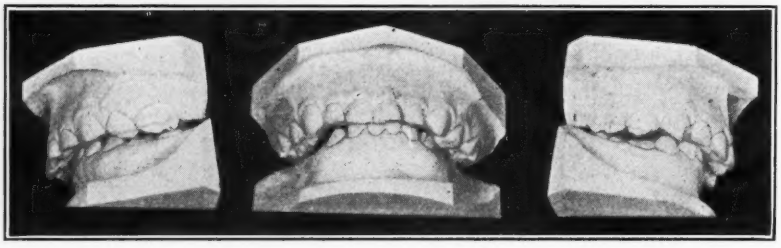


Fig. 10.—Deciduous denture.

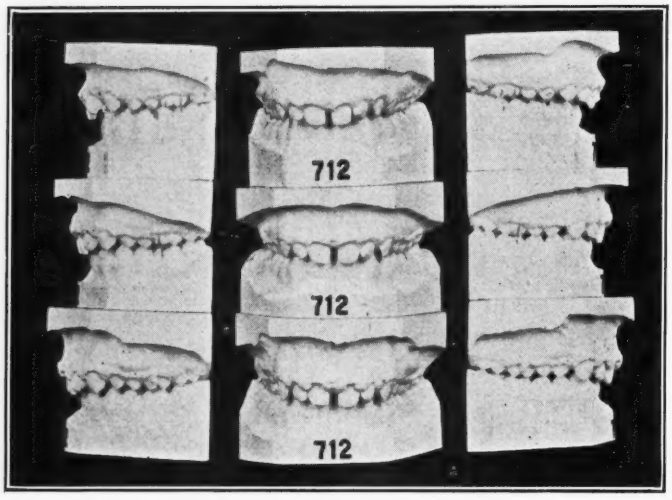


Fig. 11.—Showing three models: original, study, and last model after treatment.

Finally, a short description of the central incisor region: The x-ray picture in Fig. 9 is very outstanding. You can take a spatula and insert it in a fold in the gum tissue between the central incisors extending directly upward about one-quarter inch.

Fig. 10 shows a condition in a deciduous denture, the beginning of a deformity similar, I believe, to the one in this report. The correction of this deformity at five years of age, I believe, will obviate the subsequent bone deformity.

In recapitulation I want to emphasize the following interesting points of the case: (1) early local treatment for nasal discharge and irritation without favorable results. (2) the continuous application of the handkerchief, stimulating the growth of the middle of the face, also the highly nervous manner; (3) the easy response to orthodontic treatment only up to a certain point; (4) recovery of a normal nasal and respiratory function by the institution of body hygiene; (5) the extreme rebellion of all mouth tissue when further orthodontic treatment was attempted.

Has orthodontia anything further to offer this patient?

TREATMENT OF A CLASS III ADULT CASE WITH THE USE OF VULCANITE BITE BLOCKS*

EDWARD I. SILVER, D.M.D., BOSTON, MASS.

HISTORY.—Patient, male, aged twenty-six years, in good general health, presented for treatment May 10, 1931. No history of hereditary characteristics. Radiographs did not reveal anything of significance. Photographs showed a characteristic and marked prognathism of the lower third of the face (Fig. 1).

Fig. 1.

Fig. 2.

Etiology.—With no history of hereditary characteristics, I cannot explain the causative factors in this case.

Diagnosis.—This case was mutilated by loss of teeth; therefore the usual landmarks cannot be used as basis for diagnosis. However, Angle's Class III is the classification upon which treatment was based. The patient's facial profile would confirm this.

Treatment.—Because of extreme depth of the lingual version of the maxillary anterior teeth (Fig. 2), it was deemed advisable to build vulcanite bite

*Read before the New York Society of Orthodontists, New York, N. Y., March 24, 1936. Presented to the American Board of Orthodontia, April 20, 1936.

blocks (Fig. 3) on each side on the mandibular posterior teeth and cement them into place, opening the bite to a point sufficient to permit the labial movement of the maxillary anterior teeth without interference from the mandibular anterior teeth (Fig. 4). Using mass anchorage, bracket bands were made

Fig. 4.

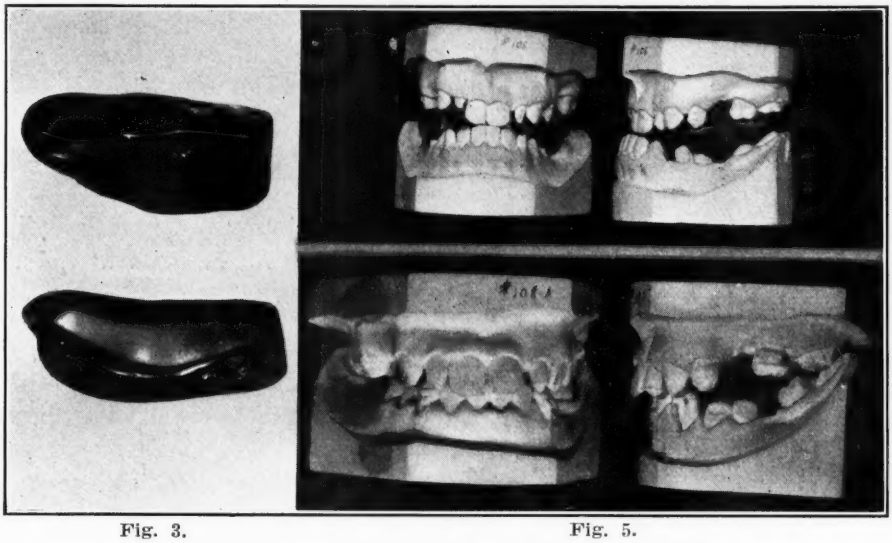


Fig. 3. Fig. 5.

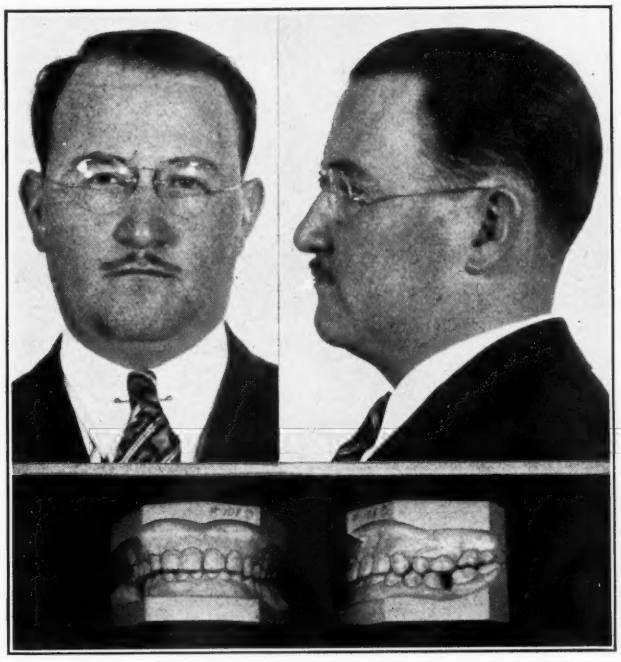


Fig. 6.

Fig. 7.

on all six mandibular anterior teeth connected by an Angle ribbon arch wire to which hooks were soldered opposite the distal of the canines for the attachment of elastic bands to the maxillary molar bands. The maxillary right first molar was banded and also the left second molar, and a round 0.036 labial arch wire was used on the maxillary arch.

Results.—In this way the spaces were closed between the mandibular canines and the first premolars and the mandibular anterior teeth retracted as well as the labial movement of the maxillary anterior teeth.

The models in Fig. 5 show the results to December, 1931 (seven months later), when the posterior vulcanite bite blocks were removed.

June, 1932, all appliances were removed, and patient was advised to have restorations made for missing teeth.

Fig. 6 shows a marked improvement in facial appearance.

Prognosis.—Models made September, 1935, as shown in Fig. 7, I believe, indicate that the patient has been benefited in many respects, and perhaps would be even more so if restorations were completed.

Although this case has not reached an ideal, it shows a worth-while improvement which has justified the treatment, aiming for an efficient functional occlusion.

FRACTURED MAXILLARY CENTRAL INCISOR*

CHESTER J. ROBERTSON, D.D.S., NEW YORK, N. Y.

THIS case is of a child seven and one-half years of age, who by a fall fractured the incisal third of a maxillary left central incisor, exposing the pulp. The root being only partially formed, an attempt was made to preserve the vitality of the pulp and see whether the normal root formation would continue.

Under novocaine the portion of the pulp in the crown was removed by means of a sharp spoon excavator. The hemorrhage was stopped by applying a

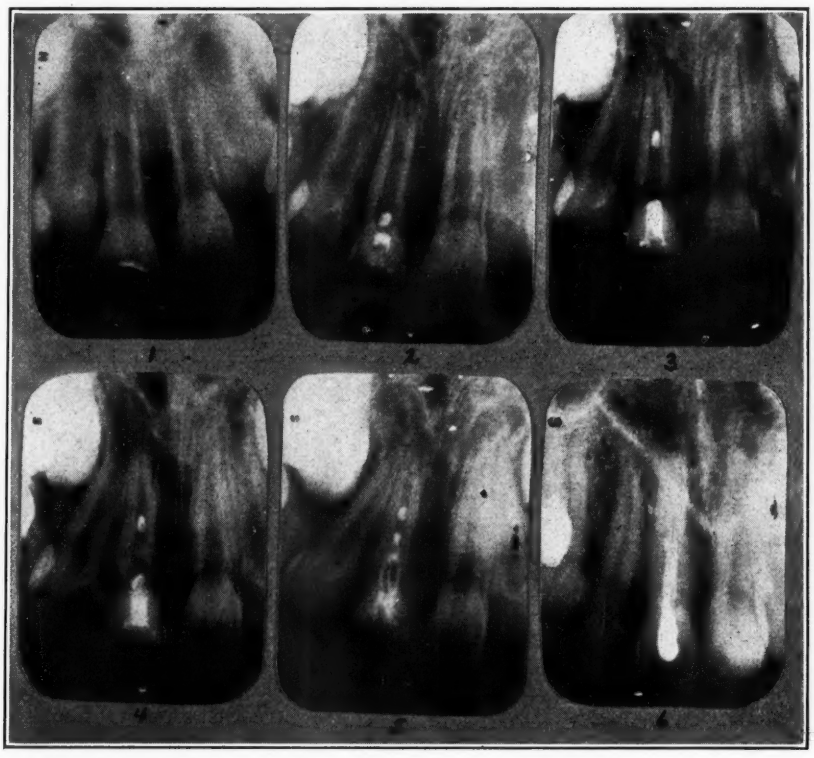


Fig. 1.—January 21, 1933.
Fig. 2.—May 20, 1933.
Fig. 3.—December 27, 1933.
Fig. 4.—June 27, 1934.
Fig. 5.—September 18, 1935.

10 per cent solution of adrenalin. A thick paste of iodoform, zinc oxide and oil of cloves was mixed, and a small piece of cotton was thoroughly saturated with the paste and placed in the pulp chamber in contact with live pulp tissue in the root. The opening was then sealed with cement. This was allowed to remain for one week, at which time the same treatment was repeated and allowed to

*Presented at a meeting of the New York Society of Orthodontists, New York, N. Y., March 24, 1936.

remain for a period of four weeks. The tooth was again opened and the pulp chamber thoroughly dried of serum which was present, placing another dressing as before. The dressings were allowed to remain, from this time on, for four months, and at each change of dressing the canal was thoroughly dried and any degenerated pulp tissue was removed so as to have the dressing resting on live tissue.

The treatment has been carried on over a period of three years, with the results which can be seen in Figs. 1-5, taken at intervals during treatment.

I do not feel that this case has been completed; and I am hoping, after a longer period of treatment, to obtain a result like that in Fig. 6, in which the root end is fully calcified. This shows a similar case treated by the same method over a period of ten years, but unfortunately the early x-ray pictures were lost.

Department of Oral Surgery

Edited by

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Articles on oral surgery, radiography, and anesthesia should be submitted to Dr. Robert H. Ivy, 1930 Chestnut St., Philadelphia, Pa. Articles on oral pathology should be submitted to Dr. Kurt H. Thoma, 47 Bay State Road, Boston, Mass.

HULLIHEN, THE ORAL SURGEON

EDWARD C. ARMBRECHT, D.D.S.,* WHEELING, W. VA.

(*Continued from page* 386.)

HULLIHEN DAY

On August 18, 1936, in connection with the Wheeling, West Virginia, Centennial Celebration, the Wheeling District Dental Society held a Scientific and Memorial Meeting, under the designation of Hullihen Day. The purpose of the meeting was twofold: first, to offer a scientific program to dentists of the surrounding territory, and, second, to present the pertinent facts regarding a fellow citizen of a hundred years ago, who has recently been accorded the distinction of being the Father of Oral Surgery.

It seems fitting that, because of this honor given to Dr. S. P. Hullihen, a permanent memorial be erected to his memory. The local society started this movement by first renovating the monument erected to him by the citizens of Wheeling in the year 1858. With the cooperation of the West Virginia State Dental Society it is hoped to raise sufficient funds to erect a monument to his memory as the Father of Oral Surgery at some later date. When this is completed a fitting ceremony will be held, which will place our fellow citizen in national recognition from a historical standpoint and offer to the traveler, interested in medical and dental pioneers, something equal to the many other distinguished monuments scattered throughout the world.

PROCEEDINGS OF HULLIHEN DAY†

"The meeting held on Hullihen Day was called to order by Frank N. Carroll, who, after the invocation by the Rev. James M. Potter, announced that the meeting was to have a twofold purpose: (1) to offer scientific instruction and (2) to honor a fellow citizen and colleague of a hundred years ago, Dr. S. P. Hullihen, who died at Wheeling in March, 1857, by making a pilgrimage to his tomb, he having recently been accorded the distinction of being the Father of Oral Surgery.

*From the oral service of the Ohio Valley General and Wheeling Hospitals.

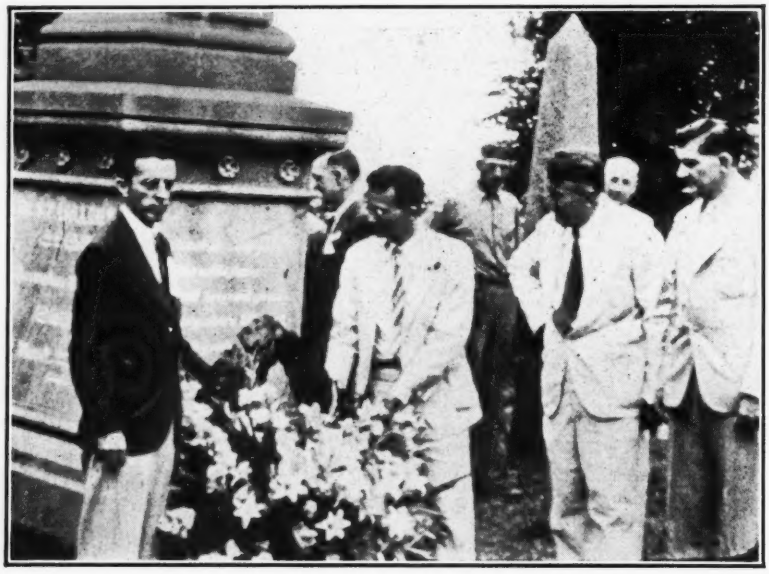
†Held during the Wheeling (W. Va.) Centennial Celebration, and sponsored by the Wheeling District Dental Society, Aug. 18, 1936.

"Mayor Schultze presented the key to the city to the visiting members of the profession. He stated that the work of such men as Dr. Hullihen had made possible the standing of the dental profession; that the profession in the United States were recognized as the dental leaders of the world, and, furthermore, that the American Dental Association, represented by its immediate Past President, Dr. Winter, was to be congratulated for maintaining this standing.

"Dr. Winter replied briefly, with a few appropriate remarks.

"The sound film on 'Exodontia,' produced by Dr. Winter, was then shown, being received with a great deal of interest.

"The pilgrimage to Mt. Wood Cemetery was made in motor cars with a police escort. This old cemetery lies on one of the highest hills in the vicinity, overlooking the beautiful Ohio River, and offers an exceptional panorama of



Wreath placed at Hullihen tomb by Drs. Carroll, Morris, Winter and Armbrecht.

the surrounding territory. C. Baxter Morris, president of the West Virginia Dental Society, opened the exercises. He spoke of the many obstacles and difficulties encountered in the days of Dr. Hullihen, many of which had now been removed and stated that we are today able to render a better service to our patients because of the work of pioneers such as Dr. Hullihen, who was a true scientist. Dr. Morris called attention to the inscriptions on the monument erected to Dr. Hullihen's memory by the citizens of Wheeling in 1858. He then directed Dr. Carroll and Dr. Armbrecht to lay a wreath on the grave, after which Rev. James M. Potter offered a prayer. . . .

"At the conclusion of the formal service, a general inspection was made of the monument inscriptions, which had been recut at the expense of the Wheeling District Dental Society. The luncheon at the Windsor Hotel was well attended. Oscar W. Burdats acted as toastmaster, introducing songsters Dorer, Jefferson, Schofield, Myers and Edwards, who rendered several selections and then led the assemblage in a few songs. A telegram was received

stating that because of illness, Dr. Walter Hullihen could not attend as he had planned. The governor of the state was called on and made a few remarks designating his especial interest in the man whom we had gathered to honor and stating that the state was justly proud of his work. Edward C. Mills, secretary of the Ohio State Dental Association, speaking on the achievements of Dr. Hullihen, quoted from Thorpe's Dental History.

EAST SIDE
Eminent as a surgeon
the wide fame
of his bold original genius
was everywhere blended
with gratitude
for his benefactions.

SOUTH SIDE
DR. S. P. HULLIHEN
Born
December 10, 1810
Died
March 27, 1857

WEST SIDE
Nothing perishes
of that
which made his life memorable
and his death lamented.
The soul—
his was affectionate, sincere,
generous, intrepid
and full of noble impulses.

NORTH SIDE
Erected
by the Citizens of Wheeling
in memory
of one who had so lived among them
that they mourned his death
as a public calamity

"The toastmaster then announced that the program would conclude by standing for one minute in silent tribute, facing the Hullihen oil portrait which had been hung high, illuminated and draped with the American flag. A short intermission followed and then the final scientific lecture was given by George B. Winter on "Routine Exodontia of Interest to the General Practitioner of Dentistry." At 4 o'clock, the meeting was adjourned so that the many interesting exhibits of the Wheeling Centennial Celebration might be seen. The committee was composed of the following members of the dental society: Drs. Broverman (chairman), Crowl, Hennen, Armbrecht and McConnell.

"The list of honored guests was as follows: H. G. Kump, governor of West Virginia; Walter Hullihen, president of Delaware University (absent because of illness); George B. Winter, past president of the American Dental Association; C. Baxter Morris, president of the West Virginia Dental Association; W. S. Fulton, president of the West Virginia State Medical Association; Robert Armbrecht, president of the Ohio County Medical Society; Jacob Schwinn, surgeon; George Vieweg, president of the Jacob Schwinn Study Club; Robert Reed, Sr., surgeon; C. A. Wingerter, physician; E. C. Mills, secretary of the Ohio State Dental Society; Charles Schultze, mayor of Wheeling; H. J. Humphrey, city manager of Wheeling; Tom Bloch, chairman of the Centennial Committee; R. Mason Hite, immediate past president of the West Virginia Dental Association; E. R. Douglass, president elect of the West Virginia Dental Association; A. J. Bush, professor in the crown and bridge department, Ohio State University."

EARLY LOCAL CARE OF FACE INJURIES

VILRAY P. BLAIR, M.D., F.A.C.S., JAMES BARRETT BROWN, M.D., F.A.C.S., AND LOUIS T. BYARS, M.D., ST. LOUIS, MISSOURI

EXCEPTING trauma of vital organs and their essential coverings, the final outcome of no injury is so directly dependent upon early proper care as injury of the face.

In the late war, special provision was made for the care of such injuries, and results appeared to substantiate this foresight on the part of the surgeon general. There were more than 8,000 facial injuries, 3,000 of the patients dying of their wounds. Of those eventually returned to this country as casualties, the majority had been injured in the earlier engagements before special provisions for care of facial injuries had been put into general operation.

In civil life, automobile accidents are especially prone to produce face injuries of a grave type, industrial accidents adding many more. Observation of a number of these cases at later periods would seem to warrant the conclusion that today many are not receiving the most appropriate care.

The bone and cartilage framework encloses the orbital cavity, mouth, nasal passages, maxillary and frontal sinuses, and external auditory canal, in addition to supporting the external tissues and giving attachment to the muscles of expression and mastication and to the teeth. The whole is made to a form that both silently and articulately expresses the emotions and, more or less plainly, the spiritual character. It is the laudable desire of most normal individuals that the face present a pleasing, or at least not a displeasing, appearance, and here injuries that might be negligible in almost any other part can bring about most grave consequences. Appearance or function of these related structures can be compromised by a bony displacement, and displacement which is allowed to persist until natural fixation occurs too often eliminates the possibility of correction or restoration by surgery.

Though the tissues are more highly resistant to infection and heal with greater facility than those of almost any other region, mucous crypts and sinuses, skin tubules and the predental tissues can harbor potentially virulent organisms that occasionally become active after injury.

Replacement of bone to approximately normal position is easily accomplished by employing the right means at the right time, but both time and means differ with different injuries, and haphazard results will often follow haphazard methods.

Excepting direct bone fixation, the teeth are the only means of obtaining absolutely accurate and stationary anchorage for mobile bone fragments, and fractures of tooth-bearing bone are most easily and accurately fixed in place

Presented before the Clinical Congress of the American College of Surgeons, Philadelphia, October 19-23, 1936.

Republished from Surgery, Gynecology and Obstetrics 64: 358, 1937.

by fastening the teeth of one jaw to those in apposition with it, a procedure instigated and popularized by the late Thomas Gilmer (Fig. 1). Direct bone fixation at the fracture site by a strand of prepared tendon or very fine silver wire passed through drill holes in the bone is a plan with which most surgeons are quite familiar.

FRACTURES OF LOWER JAW

With the following exceptions, simply wiring the lower to the upper teeth, in occlusion, will suffice in most fractures in any part of the lower jaw.

A. Lack of a usable tooth in an otherwise uncontrolled posterior frag-

Fig. 1.

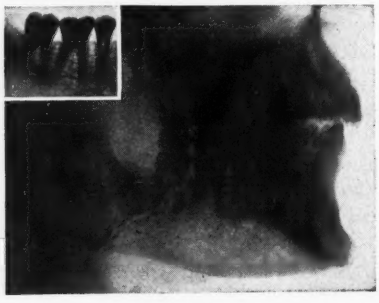


Fig. 2.

Fig. 1.—Fixation of upper jaw to lower by means of the teeth. Simple Gilmer reciprocal wiring is accomplished with soft florists' iron wire. There are modifications of this plan.

Fig. 2.—Ramus body fracture. Posterior fragment controlled by retained third molar tooth. This tooth will be later extracted both on account of the broken mesial root and also because the distal root is situated in the line of fracture.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 3.—Ramus body fracture, uncontrolled. Note the attempt to maintain apposition of the fragments by an inadequately placed wire which has done more harm than good.

Fig. 4.—Essential teeth missing or inadequate. This roentgenogram shows lack of teeth in the anterior fragment, which is compensated for by passing a silver wire completely around the chin fragment and, lacking adequate anterior dental anchorage above, this circumferential wire is fixed to a wire arch fixed to the distal teeth.

Fig. 5.—Symphysis fracture. In this case the bone is edentulous, but even with a full set of teeth a truly central fracture cannot be controlled by simply wiring the upper to the lower jaw.

ment will demand some supplementary fixation (Figs. 2 and 3). Several plans are available: direct bone wiring, fixing the coronoid process by a screw through the zygoma, some sort of dental splint, or backward tension on a silver wire engaging the posterior border of the ramus and protruding through the skin wound. If the patient is seen early, the direct bone wiring is usually

applicable, and if this can be done through the alveolar process or through the bone posteriorly and around the tooth neck in front, it is usually the simplest plan. The lingual nerve must be avoided.

B. Lack of a needed tooth in a key position in the upper jaw is the second exception. Here a wire arch made from some special material or a piece of stove or baling wire can be attached to the necks of the remaining maxillary teeth by fine wire ligatures and will give adequate upper fixation for the lower tooth wire (Fig. 4).

C. A corresponding lack in the lower arch, the third exception, can be met by placing one or more circumferential silver wires entirely around the sagging fragment upon which upward traction can be made (Fig. 4).

D. Interdental wiring might not satisfactorily eliminate movement at a true symphysis fracture. Here some other plan may be needed as a supplement or as a substitute. A low bone "wiring" made through a transverse incision along the lower border of the mandible just under the chin is the surgeon's most facile plan. This should be accomplished with prepared tendon

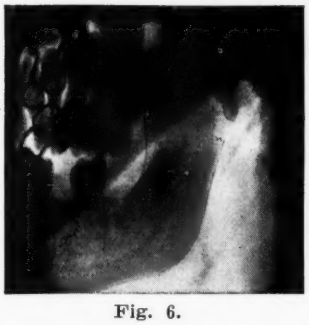


Fig. 6.

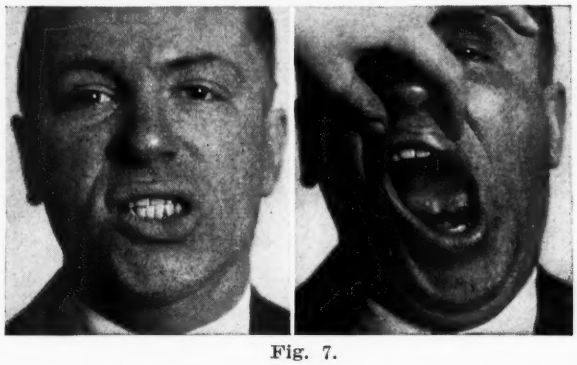


Fig. 7.

Fig. 6.—Fracture of the condyle, neck, or adjacent part of ramus. Showing the fixation of the jaws in natural occlusion and no direct replacement or fixation of the fragments.

Fig. 7.—Fracture of condyle, neck. The free mouth opening which has followed in all our cases treated by reciprocal dental fixation, but with the chin drifting toward the fractured side as the mouth opens. This latter fault will most likely improve rapidly in the next few months.

or through-and-through lacing with a strand of very fine silver wire. The latter might require removal later which is not always easy. If the teeth are adequate, a Gilmer posterior band splint is a better plan.

In fractures of the neck, condyle, or intramuscular part of the ramus, we have been content simply to fix the body of the lower jaw to the upper by interdental wiring and so far have seen no reason to regret our conservatism (Figs. 5 to 7).

Backward displacement of the chin fragment in a double fracture in the forward part of the body can usually be controlled by interdental fixation (Fig. 6). If seen later, forward traction can be obtained from a forward extension bar on an upper dental splint (Fig. 9), an outrigger from a plaster head-cap, or a counterweight working on a pulley fixed to bed or ceiling (Fig. 10). In all instances of backward displacement, a tight pressure with a Barton or 4-tail bandage is contraindicated until after replacement and fixation are established. This type of bandage produces backward pressure, which

is the reverse of what is desired. In a comparative study, two large series of cases, one treated with chin cup and bandage and one having no treatment, had on the average equally poor results (Fig. 11). The proper relations of a displaced downward chin fragment, not otherwise controllable, can be maintained by the use of an open-bite splint (Gunning type), which relaxes the pull (Fig. 12) of the mandibular hyoid muscles.

Fracture through the body of an edentulous mandible (Fig. 5) can be fixed in place by circumferential wiring of the attenuated lower jaw to the

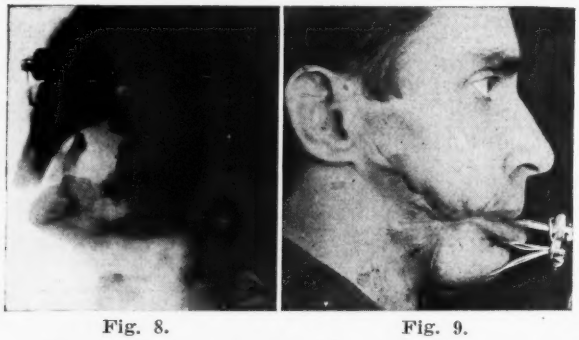


Fig. 8.

Fig. 9.

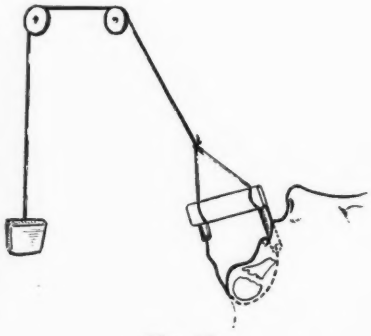


Fig. 10.

Fig. 8.—Backward displacement of edentulous chin fragment.

Fig. 9.—Backward displacement of chin fragment. Held forward by circumferential wires attached to a prolongation of an upper dental splint. This traction can also be made from a wire spring bow incorporated in a plaster head cap.

Fig. 10.—Backward displacement of chin fragment. Controlled by continuous traction of a counter weight.

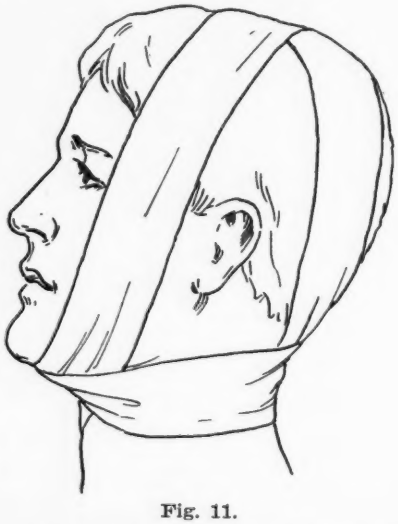


Fig. 11.

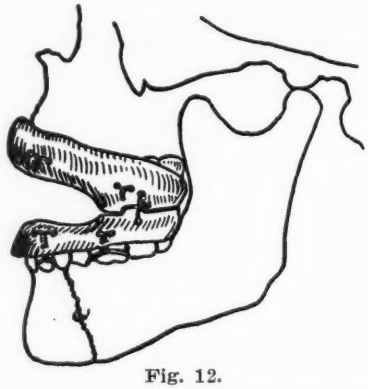


Fig. 12.

Fig. 11.—Modification of the Barton bandage to eliminate the often objectionable backward pressure on the fractured body. A snug bandage will often give a sense of comfort to the patient and it may be needed to hold a dressing in place. An elastic bandage is likely to be more comfortable than one with no stretch.

Fig. 12.—The Gunning splint releases the downward and backward pull of the mandibular hyoid muscles. This splint can be made in many forms and various materials, including the patient's own dentures.

patient's lower dental plate in one or more places and then attaching the lower to the upper plate. If need be, the two dentures could be fixed together as an open-bite splint (Fig. 13). Either way, this had best be done in collaboration with the dentist.

The simple fixation of the jaws together by wires can be done by any one of ordinary surgical skill, but those not familiar with this technic may find the patient's dentist a very desirable coworker. The soft iron wire used by florists comes in short lengths and is a convenient material for interdental wiring. With fine wire less damage will be done to the gums. Wire made especially for this purpose can be obtained from a dental supply house. While and after the teeth are wired or banded, the gums should receive care.

A real inconvenience of interdental fixation is the closed mouth, but with the help of the kitchen food grinder and an invalid feeding cup or a large syringe with a rubber tube attached, the patient can be given any kind of food desired in any quantity and without the sacrifice of a natural tooth. Possibly for a few days, food and water might best be given through a small intra-esophageal catheter passed through the nose and fixed to the cheek by adhesive plaster.

On the whole, interdental wiring is the safest, simplest, and most universally acceptable form of treatment. The dental fixation can usually be dis-

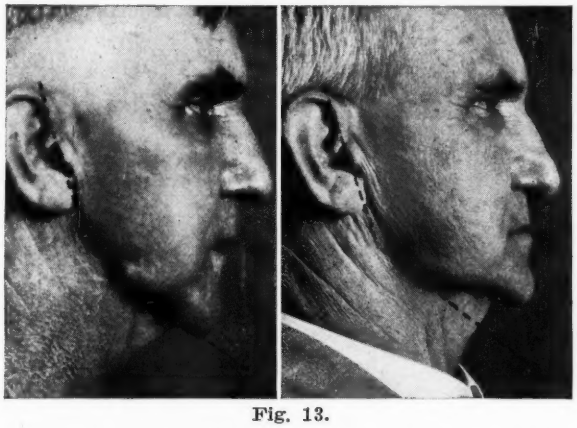


Fig. 13.

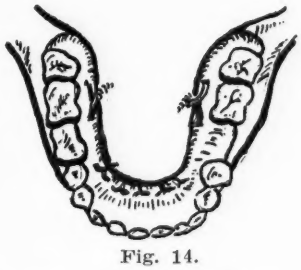


Fig. 14.

Fig. 13.—Bilateral body fracture of an edentulous lower jaw. This can best be controlled by the use of a Gunning type splint. Left, facial distortion due to malunion following direct bone wiring. Right, result obtained by opening the malunion, using a Gunning splint to which all three fragments were attached by circumferential wires.

Fig. 14.—The Gilmer posterior band splint.

pensed with before firm union is obtained, and the time can be shortened by substituting some form of dental splint. One of the simplest and best is the Gilmer posterior band splint (Fig. 14). The strength of the union should be determined by means of finger pressure, for the roentgenogram will demonstrate the line of fracture very distinctly long after a usually firm union has occurred.

Every fracture that traverses a tooth socket, at which there is any perceptible movement, should be regarded as compound and should be immediately drained through an external incision made just under the lower border of the bone. In doing this, the point of the knife should be made to slip up into this gap. Death will very rarely result from the want of this precaution, but abscess, prolonged induration, delayed union, necrosis of comminuted fragments, extensive loss of bone substance, or grave sepsis can be prevented to

a very large extent by this simple procedure. If the incision is properly placed, it can later be made invisible, if need be, by excision and resuture of the scar. When seen early, the patient's condition permitting, fractures of the body of the lower jaw should be immediately replaced and fixed and necessary drainage established (Fig. 15).

The displacements in mandibular fractures are dependent upon muscle pull, while, with the exception of a downward pull of the masseter muscle on a double fractured zygomatic process, the displacements in maxillary and nasal fractures are, as a rule, due either to gravity or to the original violence. An impacted fracture of the lower jaw is almost inconceivable, while those of the upper are of common occurrence.

Fracture of the lower jaw, like fracture of an extremity, might be conceived as more of a benefit than a calamity, because of the force expended that otherwise might have been transmitted to more vital structures (Fig. 16). Dislocation at the joint must cause a gross derangement of occlusion, but in spite of this it is sometimes overlooked.

Fig. 15.

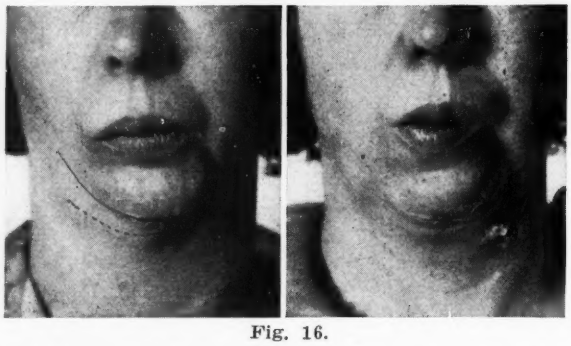


Fig. 16.

Fig. 15.—Loss of bone substance in a comminuted fracture, due most likely to lack of early inferior external drainage to the site of fracture. The wiring of the remaining fragments in their proper relation to the upper jaw will prevent facial distortion, preserve occlusion, and insure a useful jaw should there be sufficient bone reproduction to fill the gap.

Fig. 16.—Malunion of body fracture made possible by (1) loss of bone at fracture site, (2) lack of fixation of the remaining fragments in their natural positions. Right, later restoration, which required two separate operative procedures: (1) opening the malunion, fixing the fragments in natural position, and filling the resulting gap by drawing in the neighboring soft tissues. This will later serve as a suitable bed for a bone graft; (2) bridging the gap with some form of bone graft after the interposed soft tissue has thoroughly healed in place.

FRACTURES OF THE MAXILLA

Considered in relation to fractures, the term maxilla includes all the bones of the face with the exception of the frontal bone and the mandible—all together, including the lachrymal and the lateral masses of the ethmoid vomer, and parts of the sphenoid, forming one integral mass, in which fracture lines disregard anatomic boundaries. In treatment, a distinction exists between the more solid tooth-bearing part of the maxilla and the more articulate framework of the superstructure.

Alveolar Process and Palate.—Fractures of the alveolar process of either jaw fit roughly into three classes: those in which a section of the outer or inner table is pushed buccally, labially, or lingually, frequently carrying with it still attached teeth; those in which a mass of alveolar process, including

the contained teeth, is torn loose from the body of the bone; and those in which the plane of fracture traverses both the alveolar process and the body of the bone, which in the mandible really constitutes the ordinary fracture of the body. The mucoperiosteum which carries a good blood supply is so closely adherent to the alveolar bone that it is seldom that any considerable fragment of the latter is ever completely separated.

In every type of alveolar fracture the displaced fragments and the teeth which are still attached should be replaced as accurately as possible and retained either by wires or by some other dental appliance. Teeth that are to be retained after the bone has united should immediately or ultimately be placed in the care of the dentist.

The upward tilt of a stellate fracture of the palate process requires only replacement of pressure along the floor of the nose.

Superstructure.—The loculate mass above the palate can be broken in any direction, but besides a conceivably possible vertical separation of the two halves of the maxilla, there are three somewhat distinct general types. The first is along a more or less transverse plane, partial or complete, through the antra, with or without radiating fracture lines through the palate or alveolar processes, with usually little tearing of the oral mucosa. The whole palate or a portion may be quite movable, and if so, the case is treated as will be described for complete transverse fractures through the orbits. If there is any impaction, the displaced fragment should be freed before fixation is attempted. This is particularly important when the impacted palate portion has been driven upward and backward. If this is not repositioned, the persisting lack of occlusion and evident facial deformity may be of minor importance as compared with the impairment of hearing that can result from crowding of the Eustachian cushions and orifices.

Another classic plane of transverse fracture is through the orbits, nasal cavity, and pterygoid and zygomatic processes. This may be but a fissure in the bone with little tearing of the covering, to be detected only by eliciting a slight movement while grasping the vertex firmly in one hand and the dental arch with the thumb and fingers of the other; or the whole detached mass may sag down one-half inch or more, giving a characteristic elongation to the face. This fracture may be complicated by extension through the skull and dura. Not infrequently there is injury to the sixth nerve, or much more serious, the globe may be damaged or the optic nerve crushed or divided. We have fortunately never seen this latter occur bilaterally. No matter how slight the mobility, a possible fracture into the base should always be considered.

In fractures of either plane with no displacement and little excursion, one might rest content with prohibiting all chewing for three weeks, being alert to a possible increase of the false movement. In these transverse fractures, the basic principle of treatment is the same as for fractures through the substance of the lower jaw, namely, fixing the dental arches in occlusion, or if there are no teeth, the patient's dental plates can be used as in edentulous fracture of the lower jaw. Either with or without teeth, interdental wiring

or a denture splint will maintain the proper relation of jaws to face even when the lower jaw is also badly fractured, this being dependent on an acquired habitual tension of muscles of mastication.

In most lower jaw fractures, the earlier the reduction and fixation, the better, and this is true of gravity displacements of simple transverse fractures; but with comminutions or impactions of the upper loculate part, a week or ten days on the average had best elapse before restoration is attempted. One reason for this interval is to bridge a period of possible spreading infection from quiescent foci; another reason is that this time can be profitably used to improve the general and local condition of the patient.

There is usually nothing in the orbits that needs attention in the upper transverse fracture. An incidental downward displacement of the globes (Fig. 17) and displacement of the process in single zygomatic fracture should in uncomplicated cases automatically fall into place by the repositioning of the maxillary mass. In the lower transverse fractures, intraoral displacement should be molded into position. Unless symptoms dictate otherwise, the antra need not be opened, but patulence of the nasal passages must be assured.

Fig. 17.—Maxillary fracture. Left, permanently displaced malar bone and orbital border following an uncorrected fracture. Right, later correction, releasing the displaced soft tissues and building up with cartilage inlays.

Fig. 18.—Maxillary fracture. Left, downward and outward displacement of malar bone. Right, result of elevating the displaced fragment.

Fracture in either the upper or the lower plane may cause obstruction to nasal breathing from mucous swelling, if not from bony displacement, and this swelling might also extend to the mouth and pharynx, so that immediate fixation of the jaws in occlusion might seriously embarrass respiration.

Gravity displacement in the predental fixation interim can be most simply and very effectively corrected by the use of a Kingsley splint reversed, held

up by a slightly elastic pull. This splint was formerly regarded as a proper permanent fixation for these sagging fractures, but if there is comminution at the line of fracture, the upward pull can easily overcorrect or inaccurately correct it, thus causing a discrepancy in occlusion which could seriously compromise an otherwise good result. For this reason the jaws should be fixed in occlusion within two or three weeks after injury.

Another classic displacement of this region depends upon a fracture displacement of the malar bone which is almost always impacted (Fig. 18). One common displacement is inward and backward; another is slightly downward, and outward, and backward; the latter may interfere with the forward movement of the coronoid process of the mandible, thus limiting mouth opening. In either instance, the continuity of the lower or outer and lower orbital borders, and of the floor of the orbit is more or less disturbed. One of the most commonly slighted complications is a downward or backward displacement of the globe, because it is so easily overlooked in the earlier period.

Fig. 19.—Bone loss. Left, loss after removal of bone from comminuted fracture. Right, later, partial restoration with cartilage and bone transplants.

The following plan of treatment of fracture displacements of the malar bone is based on two things—the observation of a considerable number of penetrating wounds of the antrum from all ordinary types of war missiles, in various stages after injury, and the experience gained in the treatment of these fractures in civil practice.

Usually under a general anesthetic the mucosa is incised and a chisel is driven into the antrum above the first molar or premolar teeth. In a mass displacement of the malar bone, the impaction can be freed and replacement accomplished by the leverage of a heavy curved urethral sound from within the antrum combined with digital manipulation from without. The cavity can be gently, but with some firmness, and methodically packed with a one-inch or wider folded strip of iodoform gauze, lightly impregnated with balsam of Peru, so placed as to maintain the bones in position, and also as to be withdrawn without snarling. The cavity can be irrigated daily through an included Dakin's tube and the gauze removed two or three weeks later.

Many, if not most, fracture displacements of the malar bone can be approximately if not perfectly replaced by inserting a long, slender bone eleva-

tor into a small opening at the upper part of the temporal ridge, following the bony wall of the fossa, and engaging and prying the malar bone into position. This is simpler than the intramaxillary approach just described.

Fig. 20.—Depressed nasal fracture. Left, a much greater displacement, the bony bridge having been driven backward between the frontal processes. Most likely at the time of injury the patient was not in condition to permit proper replacement of the displaced bridge. The result shown in right photograph, which bore little resemblance to the original condition, was obtained by chiseling the bridge free from the frontal process, prying it partially forward, and later inserting a cartilage transplant.

Fig. 21.—Depressed nasal fracture. Left, bones spread laterally, bridge flattened. The septum has crumpled and the nose is shortened. At the time this case was seen it was still possible to pry the nasal bones forward, where they were held by a splint attached to the teeth, but the upward tilt of the tip and alæ persisted. This was later corrected by freeing the alar from the upper lateral cartilages and moving the former forward and downward on the lower border of the upper cartilages. Result is shown at right.

Backward displacement of the frontal process of the maxilla can be pried forward with a chisel inserted through the nasal cavity, and a crushed-in

frontal sinus wall can be pried out by inserting the chisel into the sinus from just under the orbital border. From no part of the face, however, should any still attached bone ever be removed at the time of the injury (Fig. 19).

A blow of a hard object, such as the end of a pole or the loose end of a culvert railing, against the upper part of the bridge of the nose will tend to drive the nasal bones either backward between the frontal processes and under the frontal bone or even under the cribriform plate of the ethmoid (Fig. 20), or it may flatten the nasal roof angle and push outward the frontal process with its anterior lachrymal crest, and perhaps the lachrymal bone, so as to impinge into the orbit, causing an increased distance between the inner canthi. Never having seen one of these in the recent state, we are not in a position to speak with authority, but it would seem that if seen early, an immediate correction might be obtained by prying forward under the depressed nasal bone with a small urethral sound and at the same time using a sharp toothed lion forceps to compress mesially the outspread bony masses. Following such

A. *B.* *C.*

Fig. 22.—Traumatic growth deformity. This seems occasionally to follow a nasal injury in early childhood, at which time displacement can rarely if ever be detected. *A*, The condition in early manhood, which was corrected by chiseling free the distorted bridge and palatal attachment of the septum and then holding the remolded nose in proper position by an outrigger attached to a dental splint, *B*. *C*, Final result.

a manipulation, the patency of the nasal duct and the infundibulum should be checked before any consolidation occurs. We can emphatically assert that the late correction of this condition is quite a formidable procedure. If the blow described above lands lower down on the nasal bridge, or if the nasal bridge lands squarely and forcefully on a hard surface, the arch may either flatten and spread laterally in front of the frontal processes or be driven between them. In either case, an intact nasal septum must crumple to permit this, and the latter should always be straightened at the time the bridge is raised (Fig. 21). If any of the intrinsic nasal cartilages are torn or detached, they should be repaired by intranasal or extranasal suture at the same time.

After the bones are raised and the septum is straightened, the nasal bridge may retain its normal contour. If not, the bones can be held accurately in place by an adjustable intranasal bar of metal attached to a dental splint (Fig. 22). The flattened lateral spread of the bridge, if not comminuted, can

be peaked up by the dental splint, or a wire mattress suture can be passed through the full thickness of the nasal wall and the septum, traversing the fracture line, and tied over a lead plate on each side. Laterally, force may have pushed the bridge over to one side and usually it is a simple matter to push it back in place where it will remain. If not, we have a choice between two plans of retention. If the nasal bones are not shattered and the upper part of the septum remains intact, a silver wire can be made to engage the bridge at the lower border of the bony part; this wire traverses the opposite nostril, passes through the cheek tissues to emerge into the mouth, and is fastened to a bicuspid or first molar tooth. It can be worn with little discomfort and is invisible. It is withdrawn through the mouth after two or three weeks. If the anterior nasal spine is displaced and impacted, it can be freed

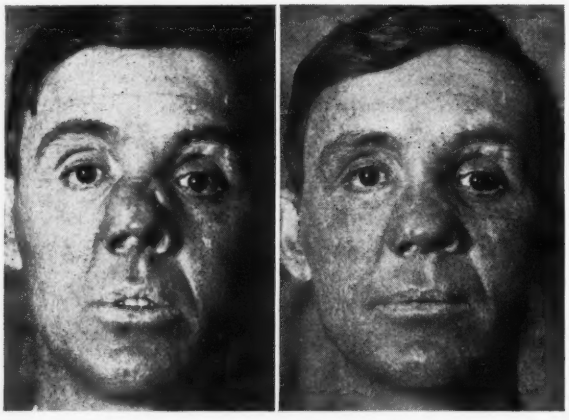


Fig. 23.—Nasal fracture with lateral displacement. Left, uncorrected fracture of some years' duration. Right, result after switching osteoplastic flaps.

Fig. 24.—Suture scars. Left, scar of a cheek wound and also scars from the suture used in the primary repair. Right, condition six years after original wound; scar was excised and resutured with buried silk. Note the original suture scars still persisting.

with a chisel driven through the upper fornix. If there is much comminution or splintering or separation of the nasal bones, then the dentally attached splint referred to above will be more effective.

Except as support to the septum, intranasal packing is ordinarily just about as helpful in accurately holding fractured nasal bones in place as the chin cup and 4-tail bandage for a mandibular fracture. Either can expedite soft tissue healing and both give a sense of security to the patient, but neither can hold a displaced bone fragment in its exact position.

A recent blow on the nose of an infant or growing child presents a peculiar problem. Many very marked deformities of the nose have, according to the history, developed gradually during the growing period, starting soon after

a nasal injury that at the time was often thought to be trivial by the physician who was consulted (Fig. 23). We have made it a rule in every case of a baby or a child so injured to explain the supposed possible results of such an injury, and if permitted, to make forceful forward pressure on the bony bridge from within, on the theory that the later hardening and distorted growth of the septal cartilage which seems to be the basic factor in these

Fig. 25.—No suture scars. Left, condition after wound had been allowed to heal without suturing. Right, final repair unmarred by suture marks.

A. *B.* *C.*

Fig. 26.—Extensive wounds. There are often reasons why these cannot, or had best not, be sutured at the time of injury, but with the exception of certain overlong or thin flaps, bound to become distorted in the healing, the final result is seldom compromised by this lack of early closure. *A*, A shell wound which cut to the bone and was dressed open. *B*, The result of spontaneous healing. *C*, What was accomplished by a later adjustment.

developmental deformities might have been induced by the abnormal backward pressure of imperceptibly depressed bone.

The keynote of the case of face fractures is exact reduction and retention before solidification occurs. In few instances can a secondary repair of a fractured face bone equal what could have been much more easily accom-

plished at the primary treatment. This also holds true for the cartilages, but in injuries of the soft tissues, early repair is not always the prime objective. The two important things are not to sacrifice any tissue at the time of injury and not to place and retain sutures that will leave scars (Fig. 24).

REPAIR OF SOFT TISSUES

Often in attempting a secondary repair of the soft tissues, one is more embarrassed by the suture marks of a primary suture than by the scar of the injury, and when the situation is further complicated by loss from a débridement, the repair may be much more difficult and the result jeopardized (Figs. 25 to 27). In these illustrative cases the face had been torn wide open and allowed to heal apparently without sutures or other means of retention.

With clean cuts in any part of the face, the attempt should be made to obtain primary union, as the resistance to infection is high and the reparative power excellent. In doing this, however, sutures that must be retained until

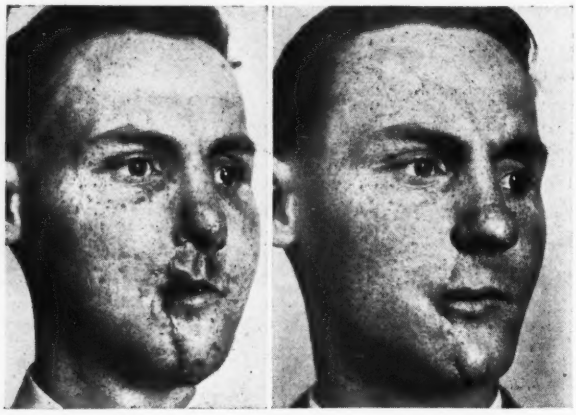


Fig. 27.—Extensive wound with loss. Left, loss of parts of mandible, chin, upper and lower lip, and the right ala nasi. Right, what was accomplished by a later adjustment.

they leave external scars should be taboo. In some places adhesive plaster or some other external adherent will give results that are acceptable at least for the time being. The walls of deep cuts can be built up by buried sutures of the very finest silk, or chromic gut sutures; the ends of the latter are left protruding so that the knot can be thrown off later. The skin is closed by a subcuticular suture or a not too tightly placed skin suture that can be removed in two days.

Indications for Immediate Suture.—Trap-door flaps cut with beveled edges, if clean-cut, should be immediately sutured in place. When seen later after the scar has drawn the flap back into place, it presents a humped-up pad of flesh surrounded by a wide surface scar, the whole being very difficult of correction. This is due to two things. Much of the thin edge of epithelium-covered derma has shrunk and crumpled until it is unusable, and, in healing, the unrestrained sheet of scar that cements down the flap has later contracted, giving the cushion form to the overlying tissues. The fact that the trap door

was beveled and not of uniform thickness makes the second raising and trimming quite wasteful. On the other hand, these have usually been cleanly sliced with sharp edged glass and are particularly well adapted to primary suture. It might be possible to place two superimposed rows of buried triple 0 white silk interrupted sutures, the deeper row being subdermal on the flap side and catching the deeper edge of the derma opposite. This should cause the thin edge of the flap slightly to override. More accurate adjustment of this overlapping edge might be attained by fine interrupted silk or horsehair sutures to be removed in forty-eight hours at most. The cleansing should be thorough, all black oil and dirt likely to produce a tattoo being removed and a firm pressure dressing applied, possibly with the help of a drain when needed, to prevent the accumulation of ooze under the flap. The drain must not be bulky; a fine strip of thin rubber tissue or a rubber band should suffice. When there is any doubt about the blood supply, then one is content to steady the flap in place with a very few deep tacking sutures (Fig. 28) and to apply gentle pressure. Fixation with elastic compressors may be attained with either a slightly elastic bandage or a patch of elastic cloth connected with adhesive.

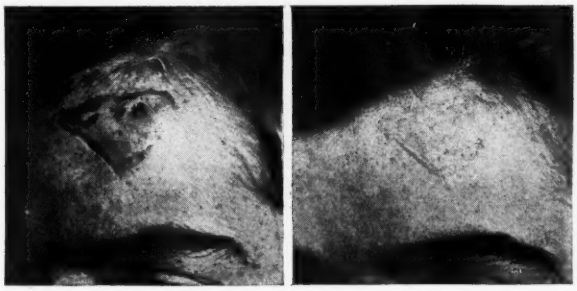


Fig. 28.—Trap-door flap. Left, a full thickness forehead flap that had been raised superficial to the periosteum by a glass cut which also divided all deeper layers of the pedicle to, and partly into, the deep surfaces of the overlying derma. At the time of injury the discoloration of the undercutting was visible from the skin surface. Any attempt accurately to suture this flap in place at this time would almost certainly have caused its death *in toto*. One tacking suture was used to insure anchorage and a gentle pressure dressing was applied. Some epithelium was lost but quite a usable part of the flap survived as shown. Right, later some of the damaged part and the bordering scar were removed and, by undermining the scalp, we were able to suture remaining part in place without distorting brow.

This mandate for immediate suture also holds for three other types of injuries:

1. The first includes cuts into or through the substance of the ear, especially when a large fragment remains attached by only a narrow pedicle. Here a limited amount of trimming of the skin or cartilage borders to insure primary union is often advisable, for it is not unlikely that even more would be lost in preparation for a secondary closure. The sutures should be so distributed as to allow for drainage of serum and blood. Distortions or collapse of the external ear canal should be immediately corrected and the lumen slightly distended with gauze or cotton. A loss of skin lining might be immediately replaced by a split free skin graft.

Subcutaneous hematoma should be removed or prevented by drainage incision, and any break in the cartilage should be adjusted with fine silk sutures, fixed with a pressure dressing. As pointed out by Davis, a damp, soft marine

"carriage" or "bath" sponge* will, under gentle pressure of the dressing, conform to all of the creases and convolutions of the ear, and makes an excellent splint.

2. Second, immediate suture is recommended for all narrow double surfaced flaps, as the border of a lip, an ear, or an eyelid, for if left hanging they are apt to become so distorted as to be beyond the possibility of use for later secondary sutures.

3. Third, all cuts or tears of the nose skin and its cartilage, including the septum, should be closed with sutures, accurately or approximately, wherever possible. This may be extremely difficult to accomplish later. In general, all wounds that look possible, circumstances permitting, should be approximated in such a way that permanent suture scars will not be left, but except in the above instances, no débridement should ever be done on face wounds beyond the trimming of shreds. Evidently contused tissue might be held in place by a few deep tacking sutures that do not include the skin. At best, in contused tissue, an attempt to do a primary skin suture is not apt to give a pleasing scar, the risk of suppuration and necrosis being increased. This does not mean, however, that the presence of a local area of contusion would necessarily preclude suture in other parts of the same wound.

Other Methods of Treatment.—In extensive through-and-through cuts of the lip or cheek, the deep portions can be approximated by sutures, put in from the mucous surface, that engage all tissue except the skin; the latter can be treated as seems desirable. If this is not practical, raw surfaces can frequently be covered to advantage by tacking the mucosa to the subdermal tissues. This practice was particularly adapted during the War to treatment at forward stations of large wounds of the cheek or lip caused by "high explosive" fragments.

The tooth penetrations of the lip, so common in childhood, or other punctures, had best be allowed to heal spontaneously. The approximation of face wounds with adhesive plaster in such a manner as to permit needed drainage is least apt to do damage and can be done so as to be extremely helpful. The question of the usability of a totally detached fragment or feature will arise sometimes. The result of all such attempts on the face that have come to our notice has been failure, but one might at times risk unending criticism by refusing the attempt. The Hindus are credited with replacing lost noses with tissue immediately transplanted from the buttock. I have seen one distal phalanx, completely severed proximal to the nail, carried to the hospital from quite a distance in a potato, that, after sutured in place by Barrett Brown, not only lived, but united so smoothly that the scar line was practically invisible.

Brush burns from sliding contact with the street or pavement present their own special problem. If not deep and fairly free from grit, surface cocainization followed by weak tincture of iodine might foster the formation

*A good quality of Mediterranean sponge known to the trade as "sheep's wool" is excellent for this purpose. Of late years we have been getting an equally good Florida sponge, which is quite a bit less expensive. These sponges are prepared by thorough washings and repeated rinsings in soft water, with about 1 in 2000 cyanide of mercury solution; they are then squeezed and dried, and stored dry as sterile.

of a dry clean scab. If this is not suitable, apply simple wet or grease dressings until clean, or better still, circumstances permitting, first scrub the surface clean of grit. It is often not possible to remove all the imbedded material, especially road oil, but imbedded grit will usually be thrown off and oil tattoos can be dealt with later (Fig. 29). Deeply imbedded grains of black gunpowder can be immediately excised, grain by grain, with a pointed cataract knife which is sharp to its needle-like point, with or without suturing each minute wound (Fig. 30). Larger foreign bodies should be removed if possible at the time of the injury, but sometimes they can be entirely overlooked.

Bits of stick and even a piece of pipestem have become lost in the faucial-palate tissue. These may be palpated, and should be removed when found. An errand boy in a steel mill carrying a short thin rod fell and exhibited a good deal of shock, but no wound was found. A few days later he died of a

Fig. 29.—Tattoo, road oil. It is improbable that scrubbing will remove embedded oil. Ordinary care usually is sufficient at the time of injury. Later the oil-stained scars can be excised, and where needed a flap or skin graft will replace the excised scar. Left, oil tattoo which was excised and partially sutured, while quite an area was covered by a full thickness graft of skin from behind the ear as shown at right.

Fig. 30.—Tattoo, powder marks. Left, part of a face that was widely peppered by deeply penetrating grains of burning black powder. At right, after the last of three operative steps of removing each separate grain and the discolored tissue, with a sharp-pointed cataract knife, and suturing each separate minute wound. The earlier this is done the more will be accomplished. There may be other worth-while ways of handling these, but we have not yet found them.

rather general sepsis and autopsy revealed that the rod had punctured the fold of the lid above the globe, and through the sphenoidal fissure, entered the middle lobe.

Deeply situated bullets, multiple shot, and metal fragments may demand nice decisions in regard to their removal.

Large clean cuts in the tongue or mucosa of the cheek might be immediately sutured, but no sutures should be put in the floor of the mouth unless free inferior drainage is provided, because of the possibility of spreading infection.

Motor nerves within the face are so thread-like that their suture is, I think, impractical, and they are here seldom completely destroyed. If Sten-

son's duct is cut, its repair had best be postponed until after the wound has healed and repair will then seldom be necessary.

Torn scalp flaps should be cleaned and sutured back in place if they still have a possible blood supply. If all or part of the scalp has been completely detached, the attempt to do split skin grafts directly on the periosteum immediately or after some cleansing effort might be quite justifiable.

Detrimental psychic reactions not infrequently follow deforming injuries. These should be watched for and, when present, combated with as much care as is bestowed upon the physical repair; if they are not overcome, the most perfect restoration may be utterly unappreciated.

DISCUSSION

Dr. Robert H. Ivy, Philadelphia.—There is little to be said in discussion of Dr. Blair's paper, except that I agree with him in all the principles that he has laid down. In the application of these principles to individual cases, there are one or two points that might be discussed.

Every surgeon who attempts to treat cases of jaw fracture should master the technique of wiring the teeth. Modifications of the method first proposed by Gilmer have, I believe, improved it. The florist's iron wire is suitable in an emergency, but 24 gauge soft brass wire is most satisfactory, and there is no reason why every hospital should not have a supply of it. Silver wire is practically useless for the purpose, as it will not withstand twisting. Above all, do not use steel wire, as it is too hard to cut off the teeth. We do not advocate the direct wiring or suturing of the bone itself across the recent compound fracture of the mandible. This usually leads to suppuration around the wire, which is soon loosened and thrown off like any other foreign body in an infected field. There are other ways available for controlling the fragments, as described by Dr. Blair.

I heartily agree in regard to the slight value of roentgenologic examination in these cases as a checkup on union. The surgeon who relies chiefly on roentgenographic reports as to position of fragments in fractures of the mandible is likely to fall into grave error. Far more reliable is clinical evidence as shown by the relationship of the lower to the upper teeth.

For reduction of fracture of the upper jaw, the reverse Kingsley arch, in connection with a plaster-of-Paris head-cap, is standard with us. An emergency arch of heavy wire can be kept on hand and adapted to fit almost any case, and then wired to the teeth.

For elevation of depressed fractures of the malar bone, we have tried practically all of the methods that have been advocated from time to time. We now use routinely the approach suggested by Gillies, introducing an angular elevator from above through a skin incision in the temporal region, the instrument passing down beneath the malar through a slit in the temporal fascia. This is usually extremely simple and requires about five minutes. It is possible that in an occasional case where there is marked comminution of the wall of the maxillary sinus, the approach through the mouth and introduction of a lever into the sinus might be better.

Dr. Warren B. Davis, Philadelphia.—During the last three decades, Dr. Blair has given to surgery many original plans of treatment, both for congenital and acquired deformities of the face, supplemented by the selection and coordination of the best that could be gleaned from the world's foremost clinics. We are fortunate this evening in having had him present this summary of his present opinions regarding the early local care of face injuries.

In securing the best functional and cosmetic results, the importance of the early care cannot be overestimated. The splendid blood supply to the facial structures makes reconstructive plastic surgery in this area surprisingly successful, provided the work is done by one who is thoroughly familiar with minute anatomic details, and has been trained to avoid adding further trauma to tissue already extensively injured. The basic principles which Dr. Blair has presented are being followed, in a large measure, in all of our better maxillofacial clinics, there being only the differences in some details, which are the variations, modifications, and some minor additions which naturally develop as personal elements in any type of surgical work.

The importance, in most cases, of bringing fractured facial bones into the best possible position soon after injury cannot be overestimated. In some fractures involving the ethmoidal area, and in comminuted fractures of the anterior walls of the maxillary sinuses, a delay of a few days may be preferable. Meticulous care in keeping the nasal and paranasal areas cleansed not only promotes more rapid healing, but greatly decreases the dangers from meningitis and later from chronic infections in the sinus areas.

In those nasal injuries occurring in childhood, which are not necessarily extensive but which so often show increasing deformity during adolescence, we believe that the deficiency in the development of the septal cartilage is often the result of a low-grade infection occurring in septal hematomas. These deformities would, in a large measure, be prevented by an incision, allowing the blood clot to be removed, or the abscess to be drained promptly if infection occurred.

Dr. Blair does not regard nasal packs of value in nasal fractures, except in cases of fracture of the septum. I am sure, however, that vaselinized gauze packs, carefully applied and changed at twenty-four-hour intervals, have often been of definite value in our cases, in giving adequate support to the bony nasal structures, after the correction of depressed fractures.

Injuries to the soft tissues are benefited and rapid healing is promoted by the frequent application of warm moist compresses by day, and during the hours for the patient's sleep, the liberal application of plain dionol, or else plain sterile vaseline. By such care, tissues which are badly traumatized can often be saved, and disfigurements correspondingly minimized.

The majority of our maxillofacial surgeons are rendering good service in the correction of these traumatic deformities, but much remains to be done in prophylactic measures. Our major industries have accomplished much by the institution of safety measures and better training of their workmen, but the crying need of our day calls for unification of state and national traffic regulations and real enforcement of the laws pertaining to them.

DIFFERENTIAL DIAGNOSIS OF LESIONS IN AND ABOUT THE ORAL CAVITY*

MIHRAN B. PAROUNAGIAN,† M.D., NEW YORK, N. Y.

IT WOULD be futile for me, at this time, to attempt to discuss all the pathologic conditions which may involve the oral cavity. The scope is too broad, and the necessity small, for there are many excellent books and articles that cover most fully these conditions, whose recognition may be of vital import both to the patient and to his dentist or physician.

Lesions which occur in the mouth are basically similar to those of the skin surface. However, because of the special conditions which prevail in the oral cavity, such as difference in color, constant heat and moisture, and difference in histologic structure, these lesions are strikingly dissimilar. Papules usually become eroded and may be covered with a whitish membrane; vesicles and bullae are rarely, if ever, seen in an unruptured state, becoming instead small erosions, or even ulcerations; secondary infection frequently supervenes to produce profound alterations in appearance. From these few remarks we can see that the study of diseases of the oral cavity is a specialized one; that prolonged and close observation is essential in order to make a clinical diagnosis of these disorders; that at times laboratory procedure only will be able to make for us the correct diagnosis.

Before beginning the discussion of individual diseases, I should like to stress the fact that the mouth is only a portion of the complicated human mechanism, and that the lesions we discover in it may be a localized expression of some systemic disease. The importance of the early recognition of this systemic disease, whether it be syphilis, tuberculosis, pernicious anemia, scurvy, pellagra or others, cannot be overemphasized. The dentist who is on the alert, who recognizes the abnormality, often before the patient is aware of its existence, has done something vital for his patient.

SYPHILIS

When I say that from the standpoint of the individual and the public health, syphilis is an extremely important disease, I can hardly be refuted. For the purposes of this discussion, we shall adhere to the classification of syphilis into three stages: the primary, or chancre stage; the secondary stage, with its generalized eruption, mucous patches in the mouth, swelling of the lymphatic glands throughout the body and systemic manifestations; the tertiary, or gumma stage, and the involvement of the central nervous system. The primary and secondary manifestations are actively infectious, while the tertiary stage has slight if any danger of transmission.

Primary Lesions.—The chancre may occur anywhere on the body, but is, for obvious reasons, most common upon the genitalia. There is no doubt, from

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my personal observations and others recorded in the literature, that of all extragenital chancres, those of the lip are the most common. Infection in these patients takes place chiefly by kissing, although it is quite possible that the infection may be acquired from a contaminated drinking cup or eating utensil.

In my experience, the chancre occurs with equal frequency upon the upper and the lower lip.[1] Let me note here that epithelioma of the lip, which at times presents a differential diagnostic problem, occurs almost invariably upon the lower lip. Most commonly chancre is a solitary lesion, but multiple chancres on and about the lips may be seen. This serves also to complicate the diagnosis, for they may then resemble the multiple crusted lesions seen in herpes simplex.

Fig. 1. Fig. 2.

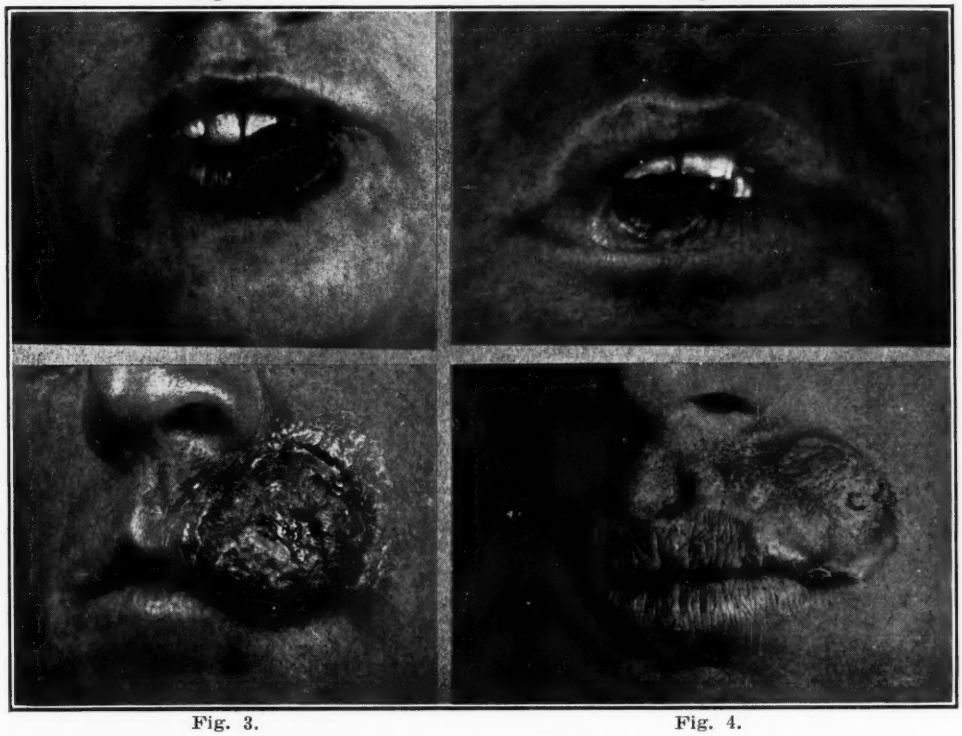

Fig. 3. Fig. 4.

Fig. 1.—Chancre of lower lip.
Fig. 2.—Epithelioma of lower lip resembling chancre.
Fig. 3.—Large chancre of upper lip.
Fig. 4.—Gumma of upper lip.

The name hard chancre, or Hunterian chancre, would imply a distinctive, readily recognizable lesion. But experience has taught us that appearance is a pitfall, that we can neither establish nor exclude the diagnosis by visual observation alone. The chancre of the lip may be nothing but a small, superficial, innocent-looking erosion or fissure; or again, it may be an ugly, crusted sore, larger than a 25 cent piece. But this we must always remember, that whether insignificant and small, or large and impressive, the chancre in this location is invariably accompanied by a considerable enlargement of the lymphatic glands corresponding to the location of the primary lesion. In-

deed, often location of these lymphatic swellings gives the trained clinician a clue to the location of the initial lesion; thus when the lymphatic swellings are present at the angle of the jaw, we suspect a chancre in the region of the tonsil; in the submaxillary regions, we look for a lip chancre; when the chancre is on the tongue or in the median line of the lip, the submental glands are enlarged. The mass of the involved glands is firm, usually homogeneous, nontender and does not suppurate.

There are a variety of conditions which may occur on the lip, where differentiation is difficult at times. The most important are herpes simplex, epithelioma, drug eruptions and chancriform pyodermia, but none of these is associated with such a rapidly developing and impressive adenopathy as the chancre.[2] I recall very well an elderly man, who was presented at one of the meetings of the Manhattan Dermatological Society by the late Dr. William S. Gottheil, with an ulcerated lesion on the tongue. The unanimous opinion on this case was that it was a malignant growth and only the timely appearance of a typical secondary syphilitic eruption saved the patient from an unnecessary surgical procedure. You can appreciate then the necessity in these cases for corroborative evidence. This is readily obtained by a dark-field examination of the lesion for the *Spirocheta pallida,* which is quite simply demonstrable in an untreated case. Where the spirocheta cannot be found in the primary sore, and the diagnosis is still in doubt, aspiration of the glandular mass will frequently lead to a discovery of the organisms.

We cannot stress too strongly the importance of prompt recognition of the chancre. From the standpoint of the dentist and the public, there is the constant danger of infection. For the patient, as all experimental and clinical investigation has shown, the earlier antisyphilitic therapy is instituted the better is his chance for complete and permanent recovery.[3]

Chancres on the tongue and tonsil are less frequent than on the lips. They, too, are invariably accompanied by massive, unilateral adenopathy, but their clinical recognition is difficult otherwise. Dark-field examination of smears from these locations is difficult, and often ambiguous, because of the presence of spirillary forms of organisms in the mouth under more or less normal conditions. Here the aspiration of the glandular mass is of greater aid, but only too often we must await the advent of the positive Wassermann reaction or the secondary eruption before we are certain of the diagnosis.

Secondary Lesions.—The principal secondary syphilitic lesions seen on the lips and in the oral cavity are the mucous patch and the "split-pea" papule. The mucous patches are usually only a local evidence of a generalized syphilitic eruption, coming on several weeks after the appearance of the secondary eruption; this may vary in different individuals, according to their habits; in heavy smokers or people who indulge in alcoholic beverages this condition may be more exaggerated. Mucous patches are seen chiefly on the inner aspect of the lips, and adjacent to the angles of the mouth, although they may be found anywhere on the buccal mucosa, the tongue or the tonsils. Characteristically, they are pea-sized, slightly raised papules, surrounded by a mild inflammatory halo, and surmounted by a grayish white membrane. They must be differentiated from aphthous ulcers, which are more inflamma-

tory, and quite sore and tender; from herpes simplex, more common on the vermilion surface of the lip, and crusted; from drug eruptions, where history of ingestion aids us. Too, the mucous patch is often part of a generalized syphiloderm. Dark-field examination of the lesion reveals the *Spirocheta pallida,* and the blood Wassermann reaction is strongly positive. The split papule of secondary syphilis is seen at one or both commissures of the mouth, and is a slightly raised, crusted papule, fissured horizontally, and must be differentiated from perlèche, a type of fungus infection in this location.

Tertiary Lesions.—The most important manifestation of tertiary syphilis about the mouth is the gumma. This lesion may involve the lip and adjacent

Fig. 5. Fig. 6.

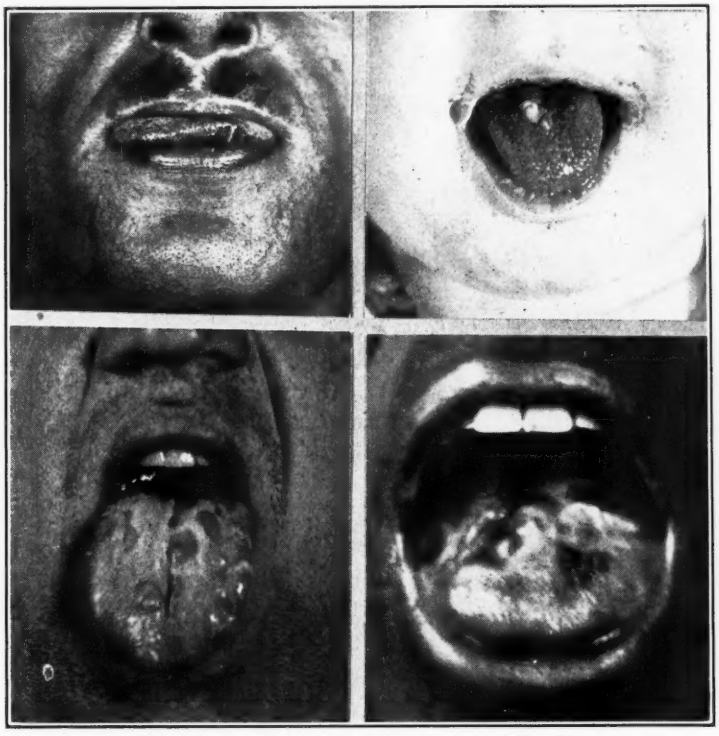

Fig. 7. Fig. 8.

Fig. 5.—Chancre of tongue.
Fig. 6.—Syphilis; hypertrophic mucous patch on tongue; split papule at commissure.
Fig. 7.—Superficial syphilitic glossitis.
Fig. 8.—Gumma of tongue.

skin, the tongue, the palate or the tonsils. It is usually a circumscribed, painless swelling, later breaking down and producing an ulcer, which will respond to no therapeutic measures except those specific for syphilis. It is important to note that trauma is often a deciding factor in the localization of gummas in the mouth; repeated irritation from a jagged tooth will often predispose to the formation of a gumma on the proximate portion of the tongue.

Differential Diagnosis.—It is also noteworthy that the factor of irritation plays an important part in the production of epithelioma in the mouth, a condition which is frequently indistinguishable clinically from gumma; the presence of a positive Wassermann does not establish the diagnosis of syphilis in such a lesion, for a syphilitic patient may develop a malignant lesion. I have

a personal knowledge of patients who were treated for a long period of time with the expectation that arsenotherapy would bring about a favorable result. In such cases it is my custom to give two or three weeks of active antisyphilitic medication with arsphenamine and mercury or bismuth; at the end of that period, if no appreciable improvement is noted, I discontinue this mode of treatment. There is a belief among a number of syphilologists that persistence in arsenotherapy, where malignancy is present, is very liable to hasten the end.

The only other important lesion to be differentiated from gumma is tuberculous ulceration. This condition is commonest on the tongue, is most usually a painful ulcer, and most often there is associated active pulmonary disease.

I should like at this point to make a few general remarks about the diagnosis of syphilitic lesions. If we recall that the Wassermann reaction does not become positive until some ten to fourteen days after the appearance

Fig. 9.—Leukoplakia of tongue.

of the chancre, we can appreciate the necessity for repeated, at least daily, dark-field examinations in order to establish the diagnosis as early as possible. In the secondary stage the diagnosis is generally easy, because of the presence of the healed or healing chancre, the generalized eruption, and the positive Wassermann test. Always remember that a patient with syphilis, as shown by positive serology, may develop any other type of disease, in other words, that not every lesion in a syphilitic patient is necessarily due to his syphilis.

LEUKOPLAKIA

Leukoplakia, in the opinion of most commentators, is chiefly caused by repeated minor irritations in a syphilitic patient. The element of time is essential, and so we can see leukoplakia principally in long-standing cases of syphilis. There is no doubt that a certain percentage of these cases may be the result of prolonged irritation, as from smoking or from jagged teeth, without there being present any underlying syphilitic disease.

The leukoplakic lesions are commonest on the buccal mucosa near the angles of the mouth. They may occur also on the inner surface of the lips and over the tongue. In appearance they are sharply defined, larger or smaller patches, bands or streaks; they are of a grayish white color, smooth and slightly raised. The pathologic importance of leukoplakia cannot be overestimated, because, according to Fordyce and MacKee,[4] the occurrence of cancerous degeneration in these lesions has been variously estimated from 20 per cent to 50 per cent, although the smaller figure is more nearly correct in my estimation. In these patients every form of irritation must be removed, be it external from excessively hot and spicy foods and tobacco, or internal from roughened carious teeth. Caustics should never be applied to the lesion.

Differential Diagnosis.—In the syphilitic cases the proper specific therapy helps many.

There are two lesions which must be differentiated from leukoplakia, namely, lichen planus and lupus erythematosus. Lichen planus usually occurs

Fig. 10. Fig. 11.

Fig. 10.—Tuberculosis of tongue.
Fig. 11.—Epidermoid carcinoma of tongue.

farther back in the mouth, is often associated with classical lesions on the skin, and is somewhat different in appearance. About lupus erythematosus, we can say that it is quite rare in the mouth as a solitary lesion, that it may extend to the lip directly from a skin lesion, and that it too has practically always typical associated skin lesions.

TUBERCULOSIS

Tuberculosis of the oral cavity is not a common condition and is rarely seen in general practice. It occurs more often in patients admitted to tuberculosis sanatoriums, as a complication of active pulmonary disease. Solitary tuberculous ulcers may be found on the tongue, and more rarely on the lip. They are usually linear and painful, but on the lip they may be circular, simulating chancre. The diagnosis is readily made by the discovery of concomitant active pulmonary disease, by the characteristic histopathology, and finally by animal inoculations. Fordyce and MacKee[4] report a case in which

an indurated, papillomatous growth was produced on the side of the tongue by a rough tooth; the condition was diagnosed as a malignancy, but biopsy revealed a typical tuberculous structure.

EPIDERMOID CARCINOMA

Malignancy in the mouth is practically always of the squamous-cell variety, highly malignant, rapidly invasive, and metastasizing early and widely. The rich vascular and lymphatic supply of the mouth makes this state of affairs readily comprehensible.

Epidermoid carcinoma may occur without any preliminary local disease, but is known to follow quite often certain conditions, such as leukoplakia, irritation from jagged teeth, and the breaking down of a gummatous nodule. On the lip, the lesion is frequently quite innocuous in appearance, consisting of a small eroded area, usually depressed and crusted centrally, and with a delicate, slightly raised and somewhat translucent border. Within the mouth, the lesion, dependent upon its duration, consists of a smaller or larger indurated ulcer. Such a condition is most likely to be confused with primary or tertiary syphilis, or tuberculous ulceration. From primary syphilis it is usually readily differentiable by the criteria already mentioned. The exclusion of gumma and tuberculosis is often impossible except by histopathologic study, particularly in ulcerous lesions of the tongue. Biopsy should be resorted to early, to eliminate the possibility of malignancy, which may be present even though the patient is syphilitic.

ERYTHEMA MULTIFORME

We are concerned only with the vesicobullous form of this disease, in which lesions on the lips are usually associated with characteristic skin surface eruption. The lip lesions are generally crusted, the patient is, as a rule, acutely ill, and the diagnosis is simple when we note the typical rash on the extremities. The blood Wassermann reaction is negative.

PEMPHIGUS

Pemphigus is a serious systemic disease, characterized by the eruption of bullous lesions over the body and in the mouth, increasing cachexia, and usually a fatal termination. I mention this condition because all of us have seen this disease causing oral lesions alone, before the outbreak of the cutaneous manifestations occurred. The mouth lesion is primarily a bulla, but we see it practically always as an eroded, mildly inflammatory, membranous patch. I recall a patient at a clinic, who for some time had been under treatment for a Vincent's stomatitis, in whom the diagnosis of pemphigus was fairly obvious from appearance of the oral lesions.

DRUG ERUPTIONS

Many drugs have been reported as agents responsible for the production of mouth eruptions, but I shall mention only a few of the more common and important ones. First, the barbital group, of which luminal is a good example, produces in susceptible persons a mildly erythematous erosion, with a grayish white membrane, which may closely simulate the mucous patch of syphilis.

Second, phenolphthalein, so widely used in proprietary catharties, and producing an eruption very much like that of the barbital group.[5] The history of ingestion, and the contemporary presence of a typical skin surface eruption make the diagnosis usually facile.

Mercury and bismuth, employed in antisyphilitic therapy, may produce in their mildest form, a fine, punctate, but apparently linear, pigmentation along the gum margins. This is especially true in patients treated for a long period of time. In patients having infected teeth and gums, the exhibition of

Fig. 12.—Erythema multiforme, bullous type, with mouth lesions.

these drugs may lead to a stomatitis of variable severity, with marked redness and swelling of the gingiva, fetor oris, purulent discharge, ptyalism; in very severe cases osteomyelitis of the maxilla or mandible may supervene.[6] We can appreciate the necessity for careful dental hygiene in patients under treatment for syphilis.

LICHEN PLANUS

This condition occurs in at least 50 per cent of the cases accompanied by typical lesions upon the cutaneous surface. In those cases in which it is present

in the mouth alone, differential diagnosis may be difficult. It must be differentiated from leukoplakia, which usually occurs more anteriorly in the mouth; both may, however, involve the surface of the tongue. In lichen planus, the whitish patches are not homogeneous as in leukoplakia; they are inclined to be stellate, or reticulated, forming suggestive mosaic patterns. According to Fordyce and MacKee,[4] "lichen planus in the mouth is generally asymptomatic and is never followed by malignant change."

Fig. 13.—Lupus erythematosus of face and lip.

Fig. 14.—Geographic tongue.

LUPUS ERYTHEMATOSUS

When the mucous membrane presents lupus erythematosus, it is most usually involved by direct extension from a lesion on the adjacent skin surface. However, in rare cases, isolated and independent lesions have been noted on the lips or in the mouth.[7] The usual lesion is hyperemic, with areas of grayish-white discoloration, some telangiectasia, and in later stages atrophy. The diagnosis is simplified by the almost invariable presence of typical skin lesions.

MOELLER'S GLOSSITIS

This condition often comes first to the attention of the dentist, with a history of persistent and frequently intractable burning of the tongue. The lesion is not striking, consisting at most of some well-defined reddish areas on the tongue. Ingestion of food may aggravate the burning sensation, and cure is difficult. One case has been reported in which the removal of infected teeth and the treatment of a pyorrheal condition resulted in a cure.[8]

PERLÈCHE

This disease is seen a great deal today, and while not of any serious import, may lead to erroneous diagnosis. It consists of a reddish, eroded area, at one or both commissures of the mouth, and often is covered with a little grayish white, loosely attached membrane, or a small crust. It is caused by infection with Monilia, and must not be mistaken for the mucous patch or split papule of syphilis.

LINGUA GEOGRAPHICA

This condition, also called erythema migrans or "wandering rash," is another innocent and not very important one, which I include simply because it may mistakenly lead to some rather frightening diagnosis. Its cause is unknown, and it is most often congenital in origin, but it may be present in a syphilitic patient and then lead to some confusion. It occurs on the dorsum and margins of the tongue and consists of circumscribed reddish areas, with a narrow white border. The lesions enlarge centrifugally, and produce all sorts of bizarre patterns. There are no subjective symptoms, and the condition is remarkably chronic and unresponsive to therapy.

CONCLUSION

I hope that I have been able to convey the importance of close observation of the oral cavity in every patient, even though no subjective symptoms are complained of. Such observation will give gratifying rewards, not alone in the obvious benefits derived by your patients, but also in the pleasure of increasing confidence and knowledge in yourselves.

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Department of Orthodontic Abstracts and Reviews

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Full and Partial Denture Construction. Lee Walter Doxtater, D.D.S., former Professor of Crown and Bridge Prosthesis, New York University. Dental Items of Interest Publishing Company, Brooklyn, N. Y., 257 pages, 251 illustrations.

In this book, the writing of which was interrupted by his death and which was finished by John Oppie McCall with the assistance of Doxtater's technician and his secretary, there is presented an interesting and an intensely practical outline of the principles and practice of denture construction. Doxtater had achieved a reputation in this field fully equal to that which he enjoyed in the field of crown and bridge work. He frequently expressed his opinion that the studies of problems in denture construction being made by research workers, while of great value, had tended to confuse the general practitioner because of expression of diverse views and had created the feeling that denture work is more complicated than it actually is. This book is his attempt to present the fundamentally sound technics in as simple a form as possible. He has also presented a special technic, still further simplified, for the dentist who, under certain conditions, must reduce his fees below normal level. The book should therefore fill a long-felt need.

Outstanding in this book are the author's clear and detailed description of technic and the voluminous illustration of the successive steps in the various procedures he presented. If anything short of personal demonstration could serve to teach the methods he advocated, this book should so serve.

Doxtater not only presented the technics of impression taking, preparation and mounting of casts and the other steps in denture construction, in such a manner that the mechanics of this phase of practice could be readily followed, but he gave considerable attention to the question of esthetics. This he rightly held to be an extremely important component of satisfactory denture service. This aspect of his subject he presented as painstakingly as its importance warrants, giving detailed instructions for selection of teeth, their arrangement, staining, etc.

A unique feature of his technic is his management of the troublesome problem of the impression for the full lower denture. Briefly, he advises constructing the lower denture on a cast obtained from a snap compound impression, and upon completion of the denture, resorting to immediate rebasing, utilizing the denture and the occlusion already established for providing the conditions needed to develop a satisfactory impression and cast.

The book is a fitting companion to his well-known *Modern Procedures in Crown and Bridge Work,* both in the soundness of the theory and practice and in physical make-up. It is profusely illustrated, all technics being shown step by step, and is carefully and fully indexed.

E. N.

Editorial

"My Opinion of Orthodontia"

After Gorgas eradicated yellow fever in Panama by locating the mosquito host; after the Rockefeller Foundation spent millions to conquer the hookworm disease; after the best talent in the medical profession had spent many years in the effort; it would be unjust for an intolerant physician to "break into print" with the statement that "it is easy to cure yellow fever, hookworm disease, bubonic plague, etc."

While not as spectacular or as well advertised as the story of the microbe hunters, notwithstanding, during the short space of the last thirty-five years, the richest and most complete literature of any department of dentistry has been created by orthodontists, pertaining to their subject. During this limited period, a new and highly meritorious department of dentistry has been created by only a handful of workers, inspired by the Angles, Deweys, Ketchams, Pullens, and others. It is no less unjust for the author writing in the February, 1937, issue of *Oral Hygiene* to attempt to tweak figuratively the nose of the orthodontic specialty than it is to ridicule or belittle the work done by industrious workers in other fields of medicine and dentistry.

The author's charge that orthodontists are aloof and contemptuous will no doubt be waived on account of the general knowledge of human behavior —which is about the same the world over. But the charge that "orthodontia is easy" (obviously meaning that orthodontia has been built up by a kind of scientific hocus-pocus) is all very difficult to reconcile with facts. There may be some justification for the charge that orthodontists in their great enthusiasm in regard to the advance of their subject have on occasion listened to some scientific "credit inflation" by essayists here and there in the past; however, certainly this has occurred no more frequently than it has in other departments of medicine and dentistry—moreover, any scientific theory not supported by facts soon finds its way to the ash can.

In order to be charitable, however, it must be understood that the article mentioned is quite honest in that it is labelled "My Opinion of Orthodontia." This is plainly the opinion of one man with limited experience and restricted background in the subject, and it can be of no more importance than one man's opinion of how many men there should be on the bench of the Supreme Court of the United States; it is important only in that wide publicity becomes propaganda and needs not necessarily be more than on the fringe of the truth.

The threadbare wheeze, "A little knowledge is a dangerous thing," is here exemplified again, and the casual reader sits with tongue in cheek and with the feeling of amazement upon reading this article until he comes to the last paragraph—then the cat slips clear out of the bag. The author says: "Since I enjoy my work and find orthodontia easy, no worthy patient is refused because of inability to pay my standard fee." "Standard fee"—that's the "alleoop" as the cat emerges from the well-known bag.

H. C. P.

News and Notes

Resolution of American Society of Orthodontists

The following resolution explains the action of the American Society of Orthodontists taken at its recent meeting in Chicago, April 19 to 22, inclusive. In this resolution the American Society of Orthodontists protests the discrimination of the American Dental Association against the official organ of the American Society of Orthodontists.

Resolution presented by Dr. Earl G. Jones before the Executive Council, April 22, 1937:

WHEREAS, The American Society of Orthodontists is a scientific and professional body equal in rank to that of any other dental organization; and

WHEREAS, For more than twenty-five years our official publication, the *International Journal of Orthodontia and Oral Surgery,* has served our members generously in the publication of all our proceedings; and

WHEREAS, The literature of orthodontics and dentistry has been greatly enriched through this channel; and

WHEREAS, The publishers of the Journal have cooperated fully with us in working out an ethical policy in the character of the advertising material; therefore, be it

Resolved, That the members of the American Society of Orthodontists protest the reflection cast upon our publication by the American Dental Association (of which we are a part) through the barring of our Journal from commercial exhibits at its annual meetings; and be it further

Resolved, That copies of this protest be mailed to the officers of the American Dental Association, the Trustees of the American Dental Association, the Council on Dental Therapeutics of the American Dental Association, and The C. V. Mosby Company.

Southern Section of the Pacific Coast Society of Orthodontists

A meeting of the Southern Section of the Pacific Coast Society of Orthodontists was held on Dec. 11, 1936, at the University Club in Los Angeles, Calif.

Dr. Walter Furie gave a résumé of the program of the coming meeting and urged all to be present.

Dr. A. F. Heimlich, retiring chairman, announced the selection of the officers for the coming year: Dr. C. F. S. Dillon, chairman, and Dr. D. R. McCauley, secretary.

Dr. James McCoy opened the program with an interesting résumé of his reintroduction of the open tube attachment in 1924. Dr. Harry Faulkner presented reports accompanied by reproductions of the dentures of two unusual and troublesome cases. Dr. D. R. McCauley presented reports with slides of two unusual and troublesome cases. Dr. Fred McIntosh reported his scheduled cases at the following meeting as the allotted time had been used.

The meeting adjourned at 10 P.M. to allow members to inspect a new type of model trimmer exhibited by Dr. Dave England.

Central Section of the Pacific Coast Society of Orthodontists

The regular meeting of the Central Section of the Pacific Coast Society of Orthodontists was held on Dec. 8, 1936.

Dr. Shaw, of San Francisco, delivered a paper, "The Pediatrician's Viewpoint of Orthodontics," beginning with the related history of pediatrics and enumerating a number of important facts, some of which are as follows: Breast feeding is important in the developing of the baby's jaws, but it is apparent that the number of breast-fed babies is decreasing as the number of hospital cases increases; with regard to the overprevalence of artificial feeding of infants, there is a question as to the outcome of a great number in the next quarter century; the form as well as kind of food is important in the development of teeth and jaws; endocrinology plays an important part in pediatrics as well as in orthodontia.

Dr. Robert Dunn commented on the value of breast feeding and its importance in the development of the jaws.

American Dental Assistants Association

The Thirteenth Annual Meeting of the American Dental Assistants Association will be held at Atlantic City, New Jersey, July 12-16, 1937. Headquarters will be at Chalfonte-Haddon Hall. For further information, address:

LUCILE S. HODGE, General Secretary,
401 Medical Arts Building,
Knoxville, Tenn.

Harvard Society of Orthodontists

The Fifth Annual Meeting of the Harvard Society of Orthodontists will be held at the Forsyth Dental Infirmary for Children, The Fenway, Boston, on Wednesday, May 26, 1937.

HAROLD J. NICE, Secretary,
475 Commonwealth Avenue,
Boston, Mass.

The Oral Surgery Club of England

The Oral Surgery Club has been formed in England with the object of advancing the science and art of oral surgery by providing for contact among its members, also by arranging visits to various British and foreign centers for the purpose of seeing work done by different specialists. Membership is confined to those who specialize in oral surgery or hold hospital, or other appointments pertaining to oral surgery, and who possess medical or dental qualifications.

Prof. T. Talmage Read, of Leeds, is president; Major S. H. Woods, A.D.C., and T. Hall Felton, of Grimsby, are members of the committee.

National University of Mexico Honors American Orthodontist

The National University of Mexico, through the Directory of the Dental School, invited Dr. Spencer R. Atkinson, professor of orthodontia of the University of Southern California, to hold a series of lectures on his specialty, according to Dr. S. Fastlicht, secretary of the Asociación Mexicana de Ortodoncia, of Mexico City.

Dr. Atkinson gave lectures and practical demonstrations for the development and progress of orthodontia in Mexico.

The University of Mexico rewarded his investigation in the field of orthodontia, by appointing Dr. Atkinson visiting professor.

The Mexican Dental Federation, corresponding associate of the International Federation, elected him honorary member in token of their gratitude and acknowledgment of his work, since this is the second time that Dr. Atkinson visited this country at the initiative of the Mexican Society of Orthodontia.

Notes of Interest

Dr. Herman Weinstein announces the removal of his office to 5 E. Fifty-Third Street, New York City.